VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE
data book

THICK FILM, METAL FILM AND WIREWOUND TECHNOLOGIES
VISHAY SFERNICE

VSE-DB0098-1002

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.
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VISHAY INTERTECHNOLOGY, INC.

DATA BOOK

THICK FILM, METAL FILM AND WIREWOUND TECHNOLOGIES

VISHAY SFERNICE

Metal Film Technology

Thick Film Technology

Wirewound Technology

www.vishay.com

SEMICONDUCTORS

RECTIFIERS

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

HIGH-POWER DIODES AND THYRISTORS

- High-Power Fast-Recovery Diodes
- Phase-Control Thyristors
- Fast Thyristors

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)

FETs

- Low-Voltage TrenchFET® Power MOSFETs
- High-Voltage TrenchFET® Power MOSFETs
- High-Voltage Planar MOSFETs
- JFETs

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

MODULES

- Power Modules (contain power diodes, thyristors, MOSFETs, IGBTs)

PASSIVE COMPONENTS

RESISTIVE PRODUCTS

- 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

Thick Film, Metal Film and Wirewound Technologies

Vishay S.A.
199, bd de la Madeleine
B.P. 1159
France
06003 Nice Cedex 1
Phone: +33 4 93 37 27 27
Fax: +33 4 93 37 27 26
www.vishay.com

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Thick Film, Metal Film and Wirewound Technologies

Table of Contents

Metal Film Resistors

WIREWOUND TECHNOLOGY

MOLDED RESISTORS							
REF.	DATASHEET	POWER RATING	RESISTANCE RANGE	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS L x I x H
	No.		Ω	%	°C	ppm/°C	mm
MSP 1B	50003	25 °C 1 W	0.04 to 2.2K	± 0.1 to ± 5	- 55 + 200	± 25 ± 50 ± 100	6.9 x 3.8 x 3.8
MSP 2B		2 W	0.04 to 4.7K				11.4 x 7 x 5
MSP 3B		2.5 W	0.04 to 13K				14.8 x 7 x 6.6

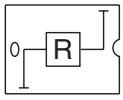
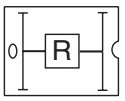
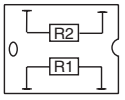
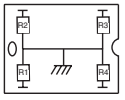
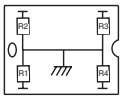
THICK FILM TECHNOLOGY

MODEL	DATASHEET	POWER RATING	RESISTANCE RANGE STANDARD MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS
	No.		Ω	%	°C	ppm/°C	mm
TO-220 CASE							
RTO 20	50005	25 °C 20 W	0.012 to 1M	± 1 to ± 10	- 55 + 155	± 150 ≥ 0.5 Ω	10.1 x 15 x 4.5
RTO 50	50035	25 °C 50 W				± 250 ≥ 0.1 Ω	10.1 x 15 x 4.5

FOR MOUNTING ONTO A HEATSINK 5 W TO 50 W							
RCH 5	50006	25 °C 5 W	0.24 to 1M	± 1 to ± 10	- 55 + 125	± 150 $R > 1\ \Omega$ ± 250 $R < 1\ \Omega$	16.6 x 9 x 15
RCH 10		10 W					19 x 11 x 15
RCH 25		25 W					28 x 14 x 15
RCH 50		50 W					47.8 x 15.5 x 15

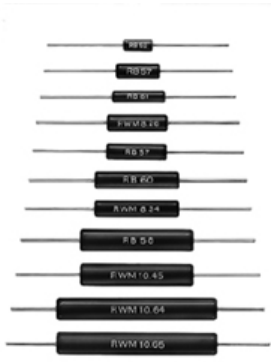
MODEL	DATASHEET	POWER RATING	RESISTANCE RANGE STANDARD MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS
	No.		Ω	%	°C	ppm/°C	mm
100 W							
 **RPH 100**	50046	25 °C 100 W	0.092 to 1M	± 1 to ± 10	- 55 + 125	± 300 < 1 Ω ± 150 > 1 Ω	65.5 x 46.7 x 21.6

WIRE THICK FILM TECHNOLOGY

MODEL	DATASHEET	POWER RATING AT 25 °C	RES. RANGE STD. MODEL	TOL. PER RES.	ELEC. DIAGRAMS	TEMP. LIMITS	TYP. TCR	DIMENSIONS
	No.		Ω	%		°C	ppm/°C	mm
SOT-227 B CASE - 20 W TO 200 W								
 **RTOP 200**	50045	200 W	0.046 to 1M	± 1 to ± 10		- 55 + 125	± 300 R < 1 Ω ± 150 R > 1 Ω	38 x 25 x 10
RTOP 100		100 W						
DRTOP 100		100 W	0.092 to 1M					
DRTOP 50		50 W						
TRTOP 40		40 W	0.046 to 1M					
TRTOP 30		30 W						
QRTOP 35		35 W						
QRTOP 20		20 W						

MODEL	DATASHEET	POWER RATING	RES. RANGE STD. MODEL	TOLERANCE	TEMP. LIMITS	TYP. TCR	DIMENSIONS
	No.		Ω	%	°C	ppm/°C	mm
HIGH POWER FOR MOUNTING ONTO A HEATSINK - 250 W AND 500 W							
 **RPS 250D**	50007	70 °C 250 W	0.24 to 1M	± 1 to ± 10	- 55 + 125	± 300 < 1 Ω ± 150 > 1 Ω	73 x 60 x 24.5
RPS 500D	50047	70 °C 500 W					

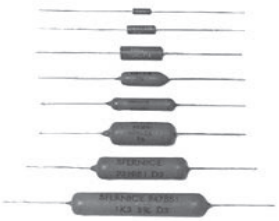
MEDIUM DISSIPATION WIREWOUND RESISTORS



REFERENCES			DATASHEET	POWER RATING	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
VISHAY SFERNICE	CECC								Ø NOM.	L NOM.
	NF	BS	No.		Ω	%	°C	ppm/°C	mm	mm
ENAMELLED-POWER (E24)										
RWM 4 x 10	RB 59	JB	50008	25 °C 3 W	(1) 5.5 W	0.1 to 10K	± 5 std. ± 1 to ± 10 on req.	- 55 + 350	+ 75	5.5	12
RWM 4 x 22	RB 61	HB		5 W	7 W	0.1 to 16K				5.5	22.1
RWM 5 x 26	RB 57	-		7 W	10 W	0.1 to 27K				7.4	24.7
RWM 6 x 22	RB 57	KB		7 W	10 W	0.1 to 39K				6.5	18
RWM 8 x 26	RB 60	-		8 W	10 W	0.1 to 27K				7.4	24.7
RWM 6 x 34	RB 60	LB		8 W	12 W	0.33 to 36K				7.4	33.7
RWM 8 x 34	RB 58	-		11 W	14 W	0.33 to 36K				7.4	33.7
RWM 8 x 45	RB 58	MB		11 W	20 W	0.47 to 62K				9.4	44.8
RWM 10 x 45	-	-		25 W	25 W	0.47 to 62K				9.4	44.8
RWM 10 x 64	-	-		25 W	25 W	0.68 to 100K				9.4	63.8
RWM 10 x 65	-	-		30 W	30 W	0.68 to 100K				9.4	63.8

Note
(1) With surface temperature 450 °C

MOLDED-INSULATED-PRECISION (E24-E48-E96)								
RLP 1 molded	RP 8	50009	25 °C 1 W	0.05 to 2.2K	± 0.1 to ± 5	- 55 + 275	± 20 ± 50	2.5	6.5
RLP 2 molded	RP 7		2 W	0.025 to 6.8K				4	10.2
RLP 3 insulated	RP 4		3 W	0.01 to 15K				5.54	14
RLP 6 insulated	-		6 W	0.02 to 59K				8.7	23.8
RLP 10 insulated	-		10 W	0.06 to 150K				10.3	46.8



MOLDED-INSULATED-PRECISION (E24-E48-E96)								
58 BSI molded	-	50011	25 °C 1 W	0.1 to 2K	± 0.5 to ± 5	- 55 + 200	± 100 ± 300	2.4	6.5
63 BSI molded	-		2 W	0.025 to 4K				3.7	10
68 BSI molded	-		3 W	0.01 to 15K				5.6	15
516 BSI insulated	-		4 W	0.01 to 20K				5	16
523 BSI insulated	-		5 W	0.015 to 40K				5	23
923 BSI insulated	-		6 W	0.02 to 60K				9	23
932 BSI insulated	-		8 W	0.035 to 100K				9	32
947 BSI insulated	-		10 W	0.06 to 150K				9	47

MEDIUM DISSIPATION WIREWOUND RESISTORS

REFERENCES			DATASHEET	POWER RATING	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
VISHAY SFERNICE	CECC								Ø NOM.	L NOM.
	NF	BS	No.		Ω	%	°C	ppm/°C	mm	mm
MOLDED-PRECISION (E24-E48-E96)										
RMB 075	-	-	50010	25 °C 0.75 W	0.1 to 2K	± 0.1 to ± 5	- 55 + 275 + 200	± 20 ± 50	2.5	6.5
RMB 1.5	-	-		1.50 W	0.1 to 6.81K				4	10.2
RMB 3	-	-		3 W	0.051 to 13K				6.4	16.2
RMBS 0.5	RP 1	-		0.50 W	0.1 to 2K				2.5	6.5
RMBS 1	RP 2	-		1 W	0.1 to 6.81K				4	10.2
RMBS 2	RP 3	-		2 W	0.015 to 13K				6.4	16.2

Note
- RMBS spare parts

CEMENTED								
SG 3	50012	40 °C 3 W	0.01 to 3.3K	± 1 to ± 10	- 55 + 200	± 150	4.8	13
SG 4		4 W	0.1 to 3.9K				5.5	15.8

Note
- Undergoes European Quality Insurance System (CECC)

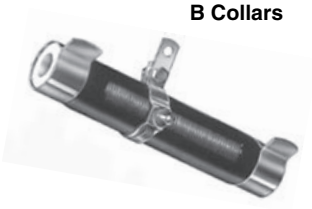
HIGH DISSIPATION WIREWOUND RESISTORS

REFERENCES		DATASHEET	POWER RATING	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
VISHAY SFERNICE	CECC CONF.							Ø NOM.	L NOM.
		No.		Ω	%	°C	ppm/°C	mm	mm
VITREOUS EXTERNAL RINGS OR COLLARS (E12)									
RW 8 x 34	-	50016	25 °C 13 W	1 to 10K	± 5	- 55 + 450	+ 75	11.5	34
RW 10 x 50	-		20 W	1 to 27K				13	50
RW 13 x 70	RB 13.70		32 W	2.2 to 56K				16	70
RW 16 x 94	-		50 W	2.2 to 56K				19.5	94
RW 20 x 117	RB 20.117		80 W	2.7 to 68K				23	117

VITREOUS EXTERNAL COLLARS ELECTRICAL TRACTION (E12)									
RWST 25 x 138	-	50017	25 °C 110 W	2.7 to 82K	± 5	- 55 + 450	+ 75	28	138
RWST 25 x 168	RB 25 x 168		180 W	2.7 to 100K				28	168
RWST 30 x 250	RB 30 x 250		320 W	4.7 to 220K				33	250
RWST 40 x 370	-		600 W	8.2 to 360K				45	370
RWST 50 x 373	-		800 W	12 to 430K				53	373

MEDIUM DISSIPATION WIREWOUND RESISTORS

RA Model
B Collars



REFERENCES		DATASHEET	POWER RATING	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
VISHAY SFERNICE	CECC CONF.	No.		Ω	%	°C	ppm/°C	Ø NOM. mm	L NOM. mm
VITREOUS ADJUSTABLE (E6)									
RA 13 x 70	RBA 13.70	50019	25 °C 21 W	33 to 3.9K	± 10	- 55 + 350	+ 75	16	70
RA 16 x 94	-		35 W	68 to 3.9K				19.5	94
RA 20 x 117	RBA 20.117		50 W	100 to 4.7K				23	117
RA 25 x 138	-		75 W	150 to 6.8K				28	138
RA 25 x 168	RBA 25.168		120 W	220 to 10K				28	168
RA 30 x 250	-		180 W	330 to 22K				33	250
VITREOUS UNDULATED WIREWOUND (E12)									
RSO 25 x 138	-	50018	25 °C 160 W	0.068 to 12	± 5 to ± 10	- 55 + 450	+ 75	39	138
RSO 25 x 168	-		200 W	0.1 to 18				39	168
RSO 30 x 250	-		350 W	0.22 to 33				44	250
RSO 40 x 370	-		700 W	0.33 to 56				54.5	370
RSO 50 x 373	-		1000 W	0.39 to 68				65	373
FIXED OR ADJUSTABLE SEMI-VITREOUS (E12)									
RSSD 8 x 34		50020	25 °C 16 W	0.12 to 10	± 5 to ± 20	- 55 + 450	± 75	10	34
RSSD 10 x 50			25 W	0.12 to 22				11.5	50
RSSD 13 x 70			42 W	0.12 to 43				14.5	70
RSSD 16 x 94			70 W	0.33 to 75				18	94
RSSD 20 x 117			100 W	0.22 to 100				22	117
RSSD 25 x 138			140 W	0.1 to 150				27	138
RSSD 25 x 168			200 W	0.12 to 220				27	168
RSSD 30 x 250			280 W	0.22 to 360				32	250
RSSD 40 x 370			450 W	0.47 to 470				43	370
RSSD 50 x 373			600 W	0.68 to 560				53	373

HEATSINK ENCASED-PRECISION (E24-E48-E96)									
REFERENCES		DATASHEET	POWER RATING (1)	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
								H NOM.	L NOM.
VISHAY SFERNICE	CECC	No.		Ω	%	°C	ppm/°C	mm	mm
RH 5	RE 4	50013	25 °C 100 W	0.01 to 12K	± 0.1 to ± 10	- 55 + 200	± 20	8.9	16.3
RH 10	RE 1		12.5 W	0.006 to 20K				11	19
RH 25	RE 2		25 W	0.006 to 62K				15	28
RH 50	RE 3		50 W	0.006 to 130K				15	50

Notes

(1) Chassis mounted

• Undergoes European Quality Insurance System (CECC)

MEDIUM DISSIPATION WIREWOUND RESISTORS

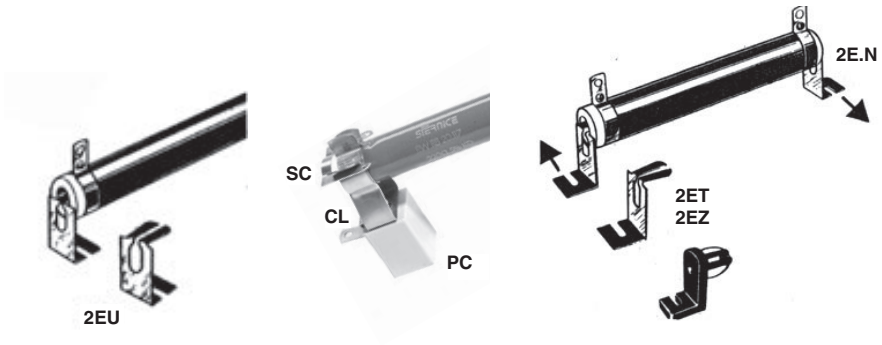
HEATSINK INDUSTRIAL APPLICATIONS								
REFERENCES	DATASHEET	POWER RATING (1)	RES. RANGE STD. MODEL	TOL.	TEMP. LIMITS	TYP. TCR	DIMENSIONS	
							Ø NOM.	L NOM.
	No.		Ω	%	°C	ppm/°C	mm	mm
SH 5	50014	25 °C 10 W	0.1 to 3.3K	± 5	- 55 + 200	± 50 $R > 5\ \Omega$	8.9	16.3
SH 10		12.5 W	0.1 to 15K				11	19
SH 25		25 W	0.1 to 33K				15	28
SH 50		50 W					15	50

Note

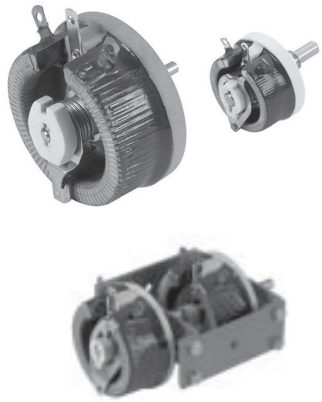
(1) Chassis mounted

MOUNTING DEVICES

See datasheets 2E, SAT and CL-SC PC



WIREWOUND RHEOSTATS



VITREOUS - RT... L MODEL (RT E6 RTE)						
REFERENCES		DATASHEET	POWER RATING	RESISTANCE RANGE STANDARD MODEL	TOL.	TEMP. LIMITS
VISHAY SFERNICE	CCTU	No.		Ω	%	°C
RT 12L/ RTE 12	PA 9	50025	25 °C 12 W	1 to 2.2K/4.7K	± 10	RT - 55 + 320 RTE - 55 + 220
RT 25L/ RTE 25	PA 1	50026	25 W	1 to 4.7K/13.5K		
RT 55L/ RTE 55	PA 3	50027	55 W	1 to10K/28K		
RT 100L/ RTE 100	PA 5	50028	100 W	1 to 15K/54K		
RT 230 L/ RTE 230	PA 7	50029	250 W	1 to 22K/95K		
RT 500L	-	50030	500 W	1 to 22K/95K 1 to 33K		

Note

• Special features, sectorial winding, ganging

Fixed Resistors of Assessed Quality

Styles qualified are listed in this document. Between two editions modifications may occur. Up-to-date information can be obtained from Vishay Sfernice of official Qualified Parts List LCIE C 00-191 or on IECQ online certificates www.iecq.org.

FIXED WIREWOUND RESISTORS

TYPE OF COMPONENTS AND RELATED SPECIFICATIONS		CONSTRUCTOR	TYPE				QUALIFIED RANGE (MAIN CHARACTERISTICS)				
			PARTICULAR LINE	DESIGNATION							
				CECC	NATIONAL	COMMERCIAL	OHMIC VALUE	TOLERANCE	P_r at 70 °C	P_r at 25 °C	TCR
EN140200	CECC 40201 Fixed High Power Resistors	Vishay Sfernice (Nice, France) Vishay Eletronic Spol Sro (Czech Republic)	001	RB 57	-	RWM 5 x 26	0.1 Ω to 10 kΩ	± 2, 5 or 10 %	5.6 W	6.5 W	< 20 Ω: ± 500 ppm/°C ≥ 20 Ω: - 50/+ 250 ppm/°C
				RB 57	-	RWM 6 x 22	0.1 Ω to 39 kΩ	± 2, 5 or 10 %	5.6 W	6.5 W	
				RB 58	-	RWM 8 x 45	0.47 Ω to 33 kΩ	± 2, 5 or 10 %	9.5 W	11 W	
				RB 59	-	RWM 4 x 10	0.1 Ω to 10 kΩ	± 2, 5 or 10 %	2.6 W	3 W	
				RB 60	-	RWM 6 x 34	0.33 Ω to 15 kΩ	± 2, 5 or 10 %	6.9 W	8 W	
				RB 61	-	S/G RWM 4 x 22 AF3/AF4	0.1 Ω to 10 kΩ	± 2, 5 or 10 %	4.3 W	5 W	
				RB 61	-	RWM 4 x 22	0.1 Ω to 6.8 kΩ	± 2, 5 or 10 %	4.3 W	5 W	
			002	JB	-	VC1/RWM 4 x 10	0.1 Ω to 10 kΩ	± 2, 5 or 10 %	2.6 W	3 W	< 10 Ω: ± 400 ppm/°C ≥ 10 Ω: ± 200 ppm/°C
				HB	-	RWM 4 x 22	0.1 Ω to 6.8 kΩ	± 2, 5 or 10 %	4.3 W	5 W	
				KB	-	VC2/RWM 6 x 22	0.1 Ω to 39 kΩ	± 2, 5 or 10 %	6 W	7 W	
			006	A	RP 8	RLP 1	1 Ω to 0.47 kΩ	± 0.5 or 1 %	0.8 W	1 W	< 1 Ω: ± 100 ppm/°C 1 Ω ≤ R < 10 Ω: ± 50 ppm/°C ≥ 10 Ω: ± 25 ppm/°C
				B	RP 7	RLP 2	0.2 Ω to 1.78 kΩ	± 0.5 or 1 %	1.25 W	1.5 W	
				C	RP 4	RLP 3	0.1 Ω to 3.57 kΩ	± 0.5 or 1 %	2 W	2.5 W	
			005	A	RP 1	RMBS 0.5	1 Ω to 174 kΩ	± 1 %	0.4 W	0.5 W	< 1 Ω: ± 100 ppm/°C 1 Ω ≤ R < 10 Ω: ± 50 ppm/°C ≥ 10 Ω: ± 25 ppm/°C
				B	RP 2	RMBS 1	1 Ω to 590 kΩ	± 1 %	0.8 W	1 W	
				C	RP 3	RMBS 2	1 Ω to 1.3 kΩ	± 1 %	1.6 W	2 W	
	CECC 40203 Fixed High Power Resistors		003	A	RE 4	RH 5	0.1 Ω to 2.7 kΩ	± 1 or 5 %	4 W*	5 W	5 Ω ≤ R ≤ 10 Ω: ± 50 ppm/°C > 10 Ω: ± 25 ppm/°C
				B	RE 1	RH 10	0.1 Ω to 4.99 kΩ	± 1 or 5 %	8 W*	10 W	
				C	RE 2	RH 25	0.1 Ω to 11.8 kΩ	± 1 or 5 %	16 W*	20 W	
				D	RE 3	RH 50	0.1 Ω to 33.2 kΩ	± 1 or 5 %	24 W*	30 W	
EN140400	CECC 40402 Fixed Surface Mounting Resistors		801	A	RW 1	MSP 1	0.5 Ω to 1 kΩ	± 1 % or Class 0.5	0.8 W	1 W	< 1 Ω: ± 100 ppm/°C 1 Ω ≤ R < 10 Ω: ± 50 ppm/°C ≥ 10 Ω: ± 25 ppm/°C
				B	RW 2	MSP 2	0.5 Ω to 2.2 kΩ	± 1 % or Class 0.5	1.6 W	2 W	
				C	RW 3	MSP 3	0.1 Ω to 4.12 kΩ	± 1 % or Class 0.5	2 W	2.5 W	

Note

• IECQ-CECC: World-wide quality approval for electronic components

FIXED METAL FILM RESISTORS

TYPE OF COMPONENTS AND RELATED SPECIFICATIONS		CONSTRUCTOR	TYPE				QUALIFIED RANGE (MAIN CHARACTERISTICS)			
			PARTICULAR LINE	DESIGNATION			OHMIC VALUE	TOLERANCE	P_r at 70 °C	TCR
				CECC	NATIONAL	COMMERCIAL				
EN140100	CECC 40101 Fixed Low Power Non Wirewound Resistors	Vishay Sfernice (Nice, France)	001	BU	RC 21 U	RCMM 02	1 Ω to 150 kΩ	± 2 or 5 %	1/4 W	± 250 ppm/°C
				EU	RC 32	RCMM 02	1 Ω to 150 kΩ	± 2 or 5 %	1/2 W	
				CU	RC 31 U	RCMM 05	10 Ω to 470 kΩ	± 2 or 5 %	1/2 W	
				FU	RC 41 U	RCMM 1	10 Ω to 1 MΩ	± 2 or 5 %	1 W	
			002	BY	RS 58 Y	RCMS 02	1 Ω to 150 kΩ	± 1 %	1/8 W	± 50 ppm/°C
				FY	RS 64 Y	RCMS 02	1 Ω to 150 kΩ	± 1 %	1/4 W	
				GY	RS 71 Y	RCMS 02	1 Ω to 150 kΩ	± 1 %	1/2 W	
				CY	RS 63 Y	RCMS 05	1 Ω to 332 kΩ	± 1 %	1/4 W	
				HY	RS 69 Y	RCMS 05	1 Ω to 332 kΩ	± 1 %	1/2 W	
				DY	RS 58 Y	RCMS 1	1 Ω to 1 MΩ	± 1 %	1/2 W	
				BP	RS 58 P	RCMA 02	1 Ω to 332 kΩ	± 0.5 or 1 %	1/8 W	± 25 ppm/°C
				CP	RS 63 P	RCMA 05	1 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	
				DP	RS 68 P	RCMA 08	1 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	
			044	CA	RS 56C	RCMT 02 K3	1 Ω to 332 kΩ	± 0.5 or 1 %	1/8 W	± 50 ppm/°C
				AE	RS 56E	RCMT 02 K4	1 Ω to 332 kΩ	± 0.5 or 1 %	1/8 W	± 25 ppm/°C
				BC	RS 60C	RCMT 05 K3	10 Ω to 100 kΩ	± 0.5 or 1 %	1/4 W	± 50 ppm/°C
				BE	RS 60E	RCMT 05 K4	10 Ω to 100 kΩ	± 0.5 or 1 %	1/4 W	± 25 ppm/°C
				CC	RS 65C	RCMT 08 K3	10 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	± 50 ppm/°C
				CE	RS 65E	RCMT 08 K4	10 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	± 25 ppm/°C
				DC	RS 70C	RCMT 1 K3	10 Ω to 1 MΩ	± 0.5 or 1 %	1 W	± 50 ppm/°C
				DE	RS 70E	RCMT 1 K4	10 Ω to 1 MΩ	± 0.5 or 1 %	1 W	± 25 ppm/°C
			802	BV	-	RCMM 02	1 Ω to 150 kΩ	± 2 or 5 %	1/4 W	± 250 ppm/°C
				CV	-	RCMM 05	10 Ω to 470 kΩ	± 2 or 5 %	1/2 W	
			803	BC	-	RCMS 02	1 Ω to 150 kΩ	± 1 %	1/8 W	± 50 ppm/°C
				CC	-	RCMS 05	1 Ω to 332 kΩ	± 1 %	1/4 W	
				DC	-	RCMS 1	1 Ω to 1 MΩ	± 1 %	1/2 W	
				BE	-	RCMA 02	1 Ω to 332 kΩ	± 0.5 or 1 %	1/8 W	± 25 ppm/°C
				CE	-	RCMA 05	1 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	
				DE	-	RCMA 08	1 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	

Note

• IECQ-CECC: World-wide quality approval for electronic components

FIXED METAL FILM RESISTORS

TYPE OF COMPONENTS AND RELATED SPECIFICATIONS		CONSTRUCTOR	TYPE				QUALIFIED RANGE (MAIN CHARACTERISTICS)			
			PARTICULAR LINE	DESIGNATION			OHMIC VALUE	TOLERANCE	P_r at 70 °C	TCR
				CECC	NATIONAL	COMMERCIAL				
EN140100	CECC 40101 Fixed Low Power Non Wirewound Resistors	Vishay Sfernice (Nice, France)	001	AU	RC 8U	NK 3	10 Ω to 510 kΩ	± 2 or 5 %	1/8 W	± 100 ppm/°C
				DU	RC 9	NK 3	10 Ω to 510 kΩ	± 2 or 5 %	1/4 W	
				BU	RC 21U	NK 4	10 Ω to 1 MΩ	± 2 or 5 %	1/4 W	
				EU	RC 32	NK 4	10 Ω to 1 MΩ	± 2 or 5 %	1/2 W	
				CU	RC 31U	NK 5	10 Ω to 1 MΩ	± 2 or 5 %	1/2 W	
			002	AY	RS 48 Y	NY 3	10 Ω to 301 kΩ	± 1 %	1/16 W	± 50 ppm/°C
				BY	RS 58 Y	NY 4	10 Ω to 1 MΩ	± 0.5 or 1 %	1/8 W	
				BP	RS 58 P	NP 4 S	100 Ω to 1 MΩ	± 0.5 or 1 %	1/8 W	± 25 ppm/°C
				EY	RS 59 Y	NY 3	10 Ω to 301 kΩ	± 1 %	1/8 W	± 50 ppm/°C
				CY	RS 63 Y	NY 5	10 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	
				FY	RS 64 Y	NY 4	10 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	
				FP	RS 64 P	NP 4 S	100 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	± 25 ppm/°C
				HY	RS 69 Y	NY 5	10 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	± 50 ppm/°C
				GY	RS 71 Y	NY 4	10 Ω to 1 MΩ	± 0.5 or 1 %	1/2 W	
			802	AV	-	NK 3	10 Ω to 510 kΩ	± 2 or 5 %	1/8 W	± 250 ppm/°C
				BV	-	NK 4	10 Ω to 1 MΩ	± 2 or 5 %	1/4 W	
				CV	-	NK 5	10 Ω to 1 MΩ	± 2 or 5 %	1/2 W	
			803	AC	-	NY 3	1 Ω to 301 kΩ	± 1 %	1/16 W	± 50 ppm/°C
				BC	-	NY 4	10 Ω to 1 MΩ	± 0.5 or 1 %	1/8 W	
				CC	-	NY 5	10 Ω to 1 MΩ	± 0.5 or 1 %	1/4 W	

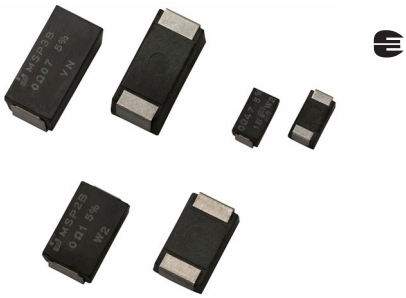
Note

• IECQ-CECC: World-wide quality approval for electronic components

Surface Mount Power Resistors

Contents

Precision Surface Mount Resistors
Wirewound or Metal Film Technologies



FEATURES

- Approved according CECC 40402-801 (wirewound)
- Wide range of ohmic values (0.04 Ω to 1 MΩ)
- Low temperature coefficient (± 25 ppm/°C available)
- Good electrical insulation
- All welded construction and molded encapsulant
- High power ratings (up to 2.5 W)
- Stability class 0.5
- Pure matte tin termination
- Compliant to RoHS directive 2002/95/EC

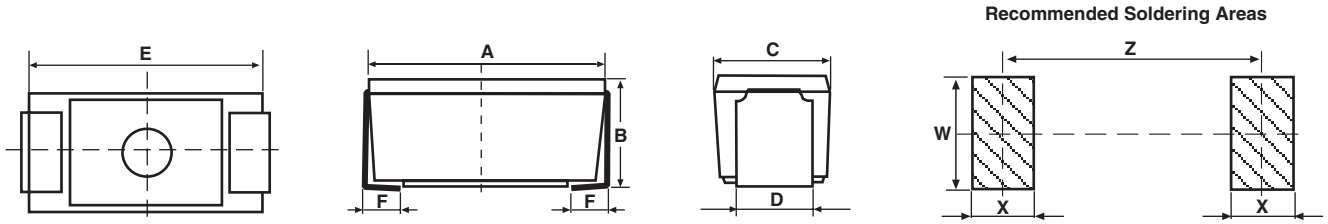
Pb-free

e3

RoHS COMPLIANT

Specially designed for surface mounting, the MSP series uses either wirewound or metal film technology. The molded package ensures mechanical and climatic protection as well as high dielectric insulation. The MSP design is compatible with surface mounting equipment and can withstand wave and reflow soldering techniques.

DIMENSIONS in millimeters



SERIES AND STYLES	A	B	C	D	E	F	W	X	Z	AVERAGE MASS (g)
MSP 1	6.9	3.8	3.8	2.5	6.5	1.4	2.7	2.9	6	0.2
MSP 2	11.4	5	7	5	11	2.4	5.2	4.1	9.4	0.8
MSP 3	14.8	6.6	7	5	14.4	2.4	5.2	4.1	12.7	1.5

Note
• General tolerance: ± 0.2 mm

TECHNICAL SPECIFICATIONS

RESISTIVE TECHNOLOGY		WIREWOUND			METAL FILM	
Vishay Sfernice Series CECC 40402-801 Metric Size		MSP 1 B RW1 0704M	MSP 2 B RW2 1107M	MSP 3 B RW3 1607M	MSP 1 C - 0704M	MSP 2 C - 1107M
Rated Dissipation at + 25 °C, P_{25}		1 W	2 W	2.5 W	0.5 W	1 W
Ohmic Range in Relation to Tolerance (with Prefered Ohmic Value Series)	± 5 % E24 Series	0.04 to 2.2K	0.04 to 4.7K	0.04 to 13K	-	-
	± 2 % E48 Series	0.04 to 2.2K	0.04 to 4.7K	0.05 to 13K	-	-
	± 1 % E96 Series	0.04 to 2.2K	0.04 to 4.7K	0.05 to 13K	10 to 332K	10 to 1M
	± 0.5 % E96 Series	0.4 to 2.2K	0.4 to 4.7K	0.3 to 13K	10 to 332K	10 to 1M
	± 0.1 % E192 Series	-	-	-	10 332K	10 332K
Approved Range CECC 40402-801	1 % or Class 0.5	0.5 1K	0.5 2.2K	0.1 4.12K	-	-
Limiting Element Voltage, $U_{max.}$ AC/DC		50 V	120 V	200 V	300 V	350 V

For technical questions, contact: sfer@vishay.com
Document Number: 50003
Revision: 02-Oct-09

TECHNICAL SPECIFICATIONS (continued)

RESISTIVE TECHNOLOGY	Wirewound			Metal Film	
Series	**MSP 1 B**	**MSP 2 B**	**MSP 3 B**	**MSP 1 C**	**MSP 2 C**
Critical Resistance	-	-	-	180K	122.5K
Temperature Coefficient	CECC 40402-801 - 55 °C/+ 200 °C < 1 Ω ± 100 ppm/°C 1 Ω to < 10 Ω ± 50 ppm/°C ≥ 10 Ω ± 25 ppm/°C			- 55 °C/+ 155 °C 10 kΩ to 332 kΩ K3: ± 50 ppm/°C K4: ± 25 ppm/°C > 332 kΩ -	K3: ± 50 ppm/°C
Failure Rate with CECC Approval	E6 10^{-6}/h	E6 10^{-6}/h	E0 or A 10^{-4}/h	-	-

MECHANICAL SPECIFICATIONS

RESISTIVE TECHNOLOGY	Wirewound	Metal Film
Encapsulant	Thermoset	
Resistive Element	CuNi or NiCr	NiCr or NiP
Ceramic Substrate	Alumina or Steatite	Alumina
Termination	Electrolytic pure matte tin	

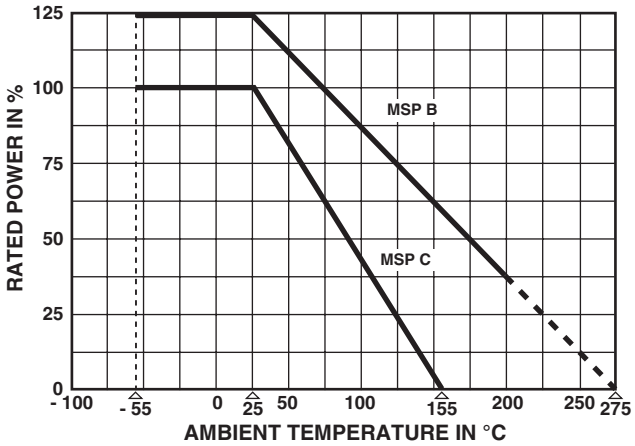
ENVIRONMENTAL SPECIFICATIONS

RESISTIVE TECHNOLOGY	Wirewound	Metal Film
Temperature Range	- 55 °C to 275 °C	- 55 °C to 155 °C
Climatic Category (LCT/UCT/days)	55/200/56	55/125/10

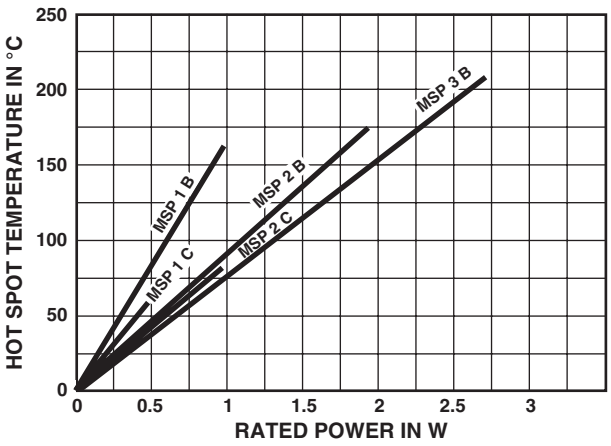
PERFORMANCE

TESTS	CONDITIONS		REQUIREMENTS	
	Wirewound	**Metal Film**	**Wirewound CECC 40402-801**	**Metal Film**
Short Time Overload	IEC 60115-1 5 P_r or U = 2 $U_{max.}$/5 s		± (0.25 % + 0.05 Ω)	± 0.25 %
Load Life	IEC 60115-1 90'/30' cycles 1000 h P_r + 25 °C 8000 h P_r		± (0.5 % + 0.05 Ω) ± (3 % + 0.05 Ω)	± 1 % -
Dielectric w/s Voltage	IEC 60115-1 U_{RMS} = 500 V/60 s		No flashover or breakdown Leakage current < 10 µA	
Rapid Change of Temperature	IEC 60115-1 IEC 60068-2-14 Test Na 5 cycles (30' at LCT/30' at UCT) - 55 °C/+ 200 °C	- 55 °C/+ 125 °C	± (0.25 % + 0.05 Ω)	± 0.25 %
Climatic Sequence	IEC 60115-1 - 55 °C/+ 200 °C	- 55 °C/+ 125 °C	± (0.5 % + 0.05 Ω)	± 0.5 %
Humidity (Steady State)	IEC 60115-1 IEC 60068-2-3 Test Ca 95 % HR/40 °C 56 days	10 days	± (0.5 % + 0.05 Ω)	± 1 %
Substrate Bending Test	IEC 60115-1 IEC 60068-2-21 Test U_{e3} 2 mm/10 times		± (0.25 % + 0.05 Ω)	± 0.25 %
Shock	IEC 60115-1 IEC 60068-2-27 Test Ea 50 *g*'s/half sine/3 times by direction (i.e. 18 shocks)		± (0.25 % + 0.05 Ω)	N/A
Vibration	IEC 60115-1 IEC 60068-2-6 Test Fc 10 Hz/2000 Hz	10 Hz/500 Hz	± (0.25 % + 0.05 Ω)	± 0.25 %
Resistance to Soldering Heat	IEC 60115-1 IEC 60068-2-58 Solder bath 260 °C/10 s		± (0.5 % + 0.05 Ω)	N/A

POWER RATING



TEMPERATURE RISE



SURFACE MOUNTING OF MSP B

Soldering cycle: 2 min at 215 °C or 10 s at 260 °C or with an iron 40 W: 3 s at 350 °C.
Soldering is possible by wave, reflow and vapor phase.

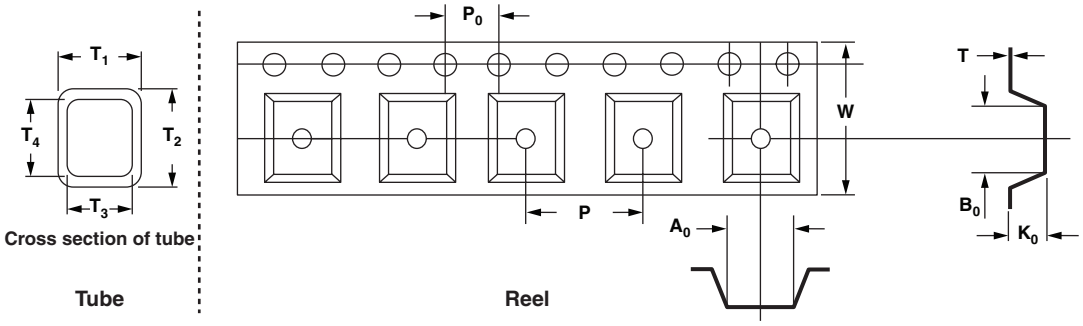
NON INDUCTIVE WINDING FOR MSP B

Non inductive (Ayrton Perry) winding available.
Please consult Vishay Sfernice.

PACKAGING

In bulk (plastic bag of 100 units or multiples)
In tube: MSP1 70 units per tube
MSP2 50 units per tube
MSP3 40 units per tube
In reel of 500 units for MSP1 and MSP2

DIMENSIONS in millimeters - Informative Data



	TUBE PACKAGING					REEL PACKAGING						
	T_1	T_2	T_3	T_4	Length	A_0	B_0	K_0	P_0	W	T	P
MSP 1	6.6	6.8	4.6	4.8	530	3.9	7.35	4.25	4	12	0.254	8
MSP 2	9.2	8.7	8	7.5	615	7.43	11.91	5.36	4	24	0.368	12
MSP 3						N/A						

MARKING

Vishay Sfernice trademark, ohmic value (in Ω), tolerance (in %), series and style, technology, manufacturing date.

Precision Surface Mount Resistors
Wirewound or Metal Film Technologies

ORDERING INFORMATION

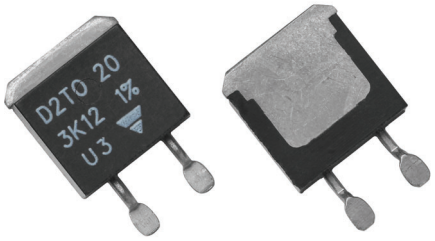
MSP	1	B		48U7	± 1 %	TC	BA100	e3
SERIES	STYLE	TECHNOLOGY B: Wirewound C: Metal Film	NON INDUCTIVE WINDING Optional	OHMIC VALUE	TOLERANCE	Applicable only in "C" technology	PACKAGING	LEAD (Pb)-FREE

SAP PART NUMBERING GUIDELINES

M	S	P		1	B	4	8	R	7	0	F		T	2	0	E	3

GLOBAL MODEL	OPTION	SIZE	OHMIC VALUE	TOL.	TEMP. COEF.	PACKAGING	SPECIAL	RoHS
MSP	**Blank** or **N** (Non inductive winding)	**1B** **2B** **3B** **1C** **2C** B = Wirewound C = Metal film	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R4700** = 0.47 Ω ...	**B** = 0.1 % **F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**Blank** or Applicable only on metal film technologies 1C and 2C: **E** ≥ K3 or **H** ≥ K4	**S14** = Bag (100 pieces) **R10** = Reel (500 pieces) **T25** = Tube (70 pieces) **T17** = Tube (40 pieces) **T20** = Tube (50 pieces)	As applicable	**E3** = Pure tin

Surface Mounted Power Resistor
Thick Film Technology

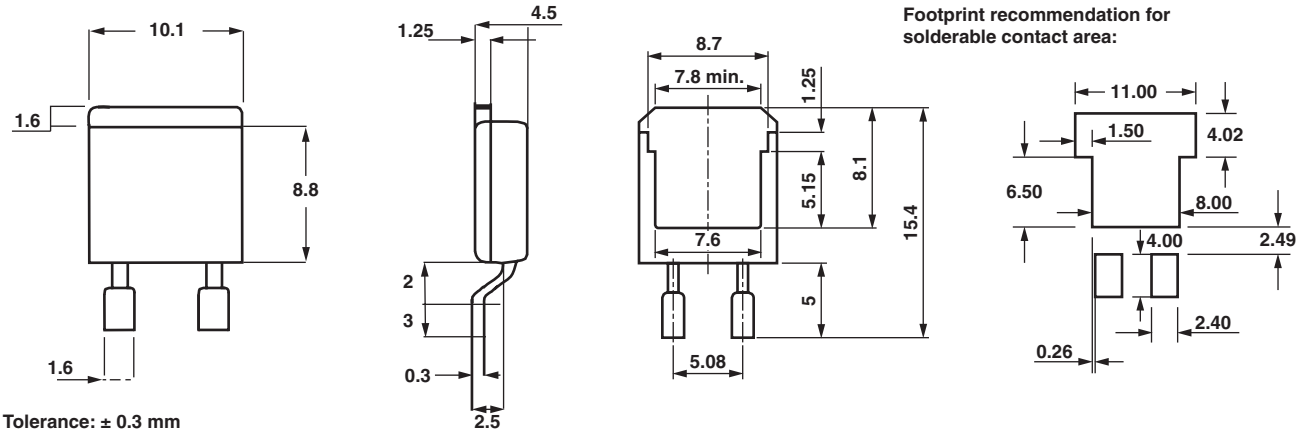


FEATURES

- 20 W at 25 °C case temperature
- Surface mounted resistor - TO-263 (D^2PAK) style package
- Wide resistance range from 0.01 Ω to 550 kΩ
- Non Inductive
- Resistor isolated from metal tab
- Solder reflow secure at 270 °C/10 s
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Notes

- For the asssembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C
- Power dissipation is 2.8 W at an ambient temperature of 25 °C when mounted on a double sided copper board using FR4 standard, 70 µm of copper, 39 mm x 30 mm x 1.6 mm

ELECTRICAL SPECIFICATIONS

Resistance Range	0.01 Ω to 550 kΩ
Tolerances (Standard)	± 1 % to 10 %
Power Rating and Thermal Resistance	20 W at 25 °C (case temperature) $R_{TH\ (j\ -\ c)}$: 6.5 °C/W
Temperature Coefficient	See Special Features table Standard: ± 150 ppm/°C
Limiting Element Voltage U_L	250 V
Dielectric Strength IEC 60115-1	2000 V_{rms} - 1 min - 10 mA max. (between terminals and board)
Insulation Resistance	≥ 10^6 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	3.12 kΩ

SPECIAL FEATURES

Resistance Values	≥ 0.010	≥ 0.045	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Requirement Temperature Coefficient (TCR) (- 55 °C + 150 °C) IEC 60115-1	± 1100 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

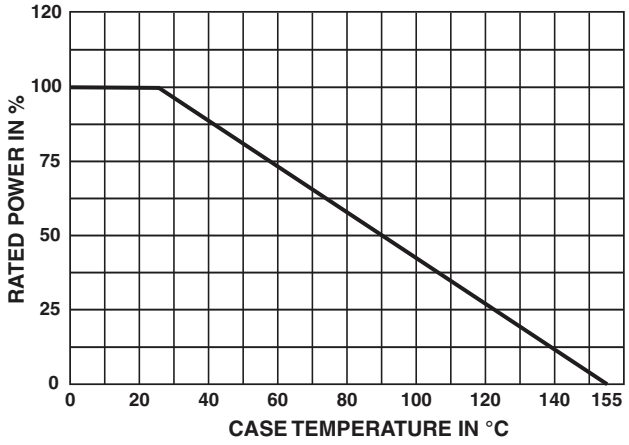
MECHANICAL SPECIFICATIONS	
Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2.2 g max.

ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	- 55 °C to 155 °C
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

DIMENSIONS	
Standard Package	TO-263 style (D^2PAK)

POWER RATING

The temperature of the case should be maintained within the limits specified.



PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 §4.13 2 P_r 5 s for $R < 2\ \Omega$ 1.6 P_r 5 s for $R \geq 2\ \Omega$ $U_S < 1.5\ U_L$	± (0.25 % + 0.005 Ω)
Rapid Temperature Change	IEC 60115-1 Test Na 5 cycles - 1 h - 55 °C to + 155 °C	± (0.5 % + 0.005 Ω)
Load Life	IEC 60115-1 1000 h at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	IEC 60115-1 IEC 60068-2-3 Test Ca: 56 days R.H. 95 %	± (0.5 % + 0.005 Ω)
Vibration	MIL STD-202 Method 204 - Test. D 10 Hz to 2000 Hz	± (0.2 % + 0.005 Ω)
Terminal Strength	IEC 60115-1 Test Ua1/Tensile: 20 N/10 s	± (0.2 % + 0.005 Ω)
Shock	IEC 60115-1 IEC 60068-2-27 Saw-tooth: 100 *gn*/6 ms	± (0.5 % + 0.005 Ω)

ASSEMBLY SPECIFICATIONS		
For the assembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Resistance to Soldering Heat	IEC 60115-1 IEC 60068-2-58 Solder Bath method: 270 °C/10 s	± (0.5 % + 0.005 Ω)
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020C 85 °C/85 % RH/168 h	Level: 1 + Pass requirements of TCR Overload and Dielectric Strength after MSL

CHOICE OF THE BOARD

The user must choose the board according to the working conditions of the component (power, room temperature). Maximum working temperature must not exeed 155 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ c)}] + [R_{TH\ (c\ -\ a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: 6.5 °C/W.

$R_{TH\ (c\ -\ a\ )}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the solder layer (according the quality of the soldering) and the thermal resistance of the board.

Example:

$R_{TH\ (c\ -\ a)}$ for D2TO20 power rating 2.5 W at ambient temperature + 25 °C.

Thermal resistance $R_{TH\ (j\ -\ c)}$: 6.5 °C/W

Considering equation (1) we have:

ΔT = 155 °C - 25 °C = 130 °C

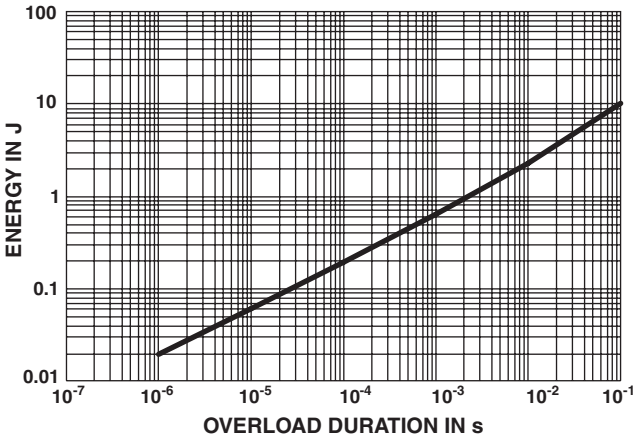
$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)} = \Delta T/P = 130/2.5 = 52$ °C/W

$R_{TH\ (c\ -\ a)} = 52$ °C/W - 6.5 °C/W = 45.5 °C/W

ACCIDENTAL OVERLOAD

In any case the applied voltage must be lower than the maximum overload voltage of 375 V. The values indicated on the graph below are applicable to resistors in air or mounted onto a board.

ENERGY CURVE



Single Pulse:

These informations are for a single pulse on a cold resistor at 25 °C (not already used for a dissipation) and for pulses of 100 ms maximum duration.

The formula used to calculate *E* is:

$$E = P \times t = \frac{U^2}{R} \times t$$

with:

E (J): Pulse energy

P (W): Pulse power

t (s): Pulse duration

U (V): Pulse voltage

R (Ω): Resistor

The energy calculated must be less than that allowed by the graph.

Repetitive or Superimposed Pulses:

The following formula is used to calculate the “equivalent” energy of a repetitive pulse or the “equivalent energy” of a pulse on a resistor that is already dissipating power.

$$E_c = E \times \left(1 + \frac{P_a}{P_r}\right)$$

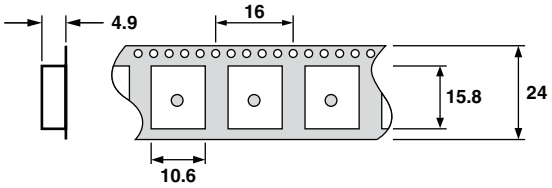
with:

E_c (J): Equivalent pulse energy
E (J): Known pulse energy
P_r: Resistor power rating
P_a: Mean power being dissipated

The energy calculated must be less than that allowed by the graph and the average power dissipated (P_a) must not exceed the continuous power of resistor.

PACKAGING

- Reel
- Tube
- Tape dimensions (mm) for reel:



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark

ORDERING INFORMATION

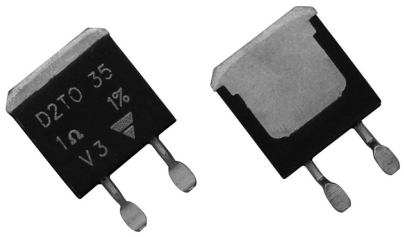
D2TO	020	C	100 kΩ	± 1 %	XXX	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	LEAD (Pb)-FREE
				F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 %	Optional on request: Shape, etc.	

SAP PART NUMBERING GUIDELINES

D	2	T	O	0	2	0	C	R	2	0	0	0	K	R	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
D2TO	**020**	**C** = Surface mount	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**R** = Reel 500 pieces **T** = Tube 50 pieces	**E3** = Pure tin

Surface Mounted Power Resistor
Thick Film Technology

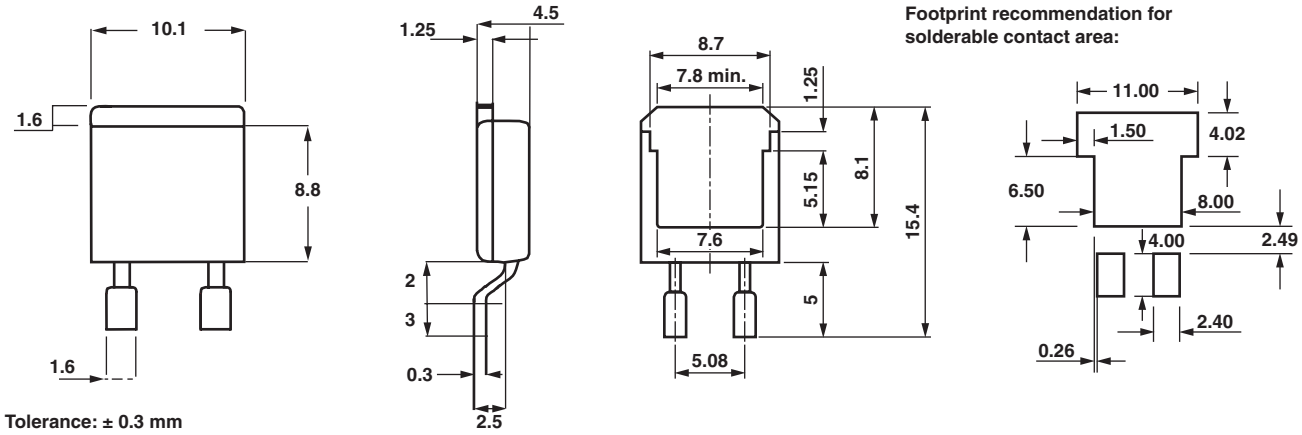


FEATURES

- 35 W at 25 °C case temperature
- Surface mounted resistor - TO-263 (D^2PAK) style package
- Wide resistance range from 0.01 Ω to 550 kΩ
- Non inductive
- RoHS compliant
- Resistor isolated from metal tab
- Solder reflow secure at 270 °C/10 s
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Notes

- For the asssembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C
- Power dissipation is 3.3 W at an ambient temperature of 25 °C when mounted on a double sided copper board using FR4 standard, 70 µm of copper, 39 mm x 30 mm x 1.6 mm

ELECTRICAL SPECIFICATIONS

Resistance Range	0.01 Ω to 550 kΩ
Tolerances (Standard)	± 1 % to 10 %
Power Rating and Thermal Resistance	35 W at 25 °C (case temperature) $R_{TH\ (j-c)}$: 4.28 °C/W
Temperature Coefficient	See Special Features table Standard: ± 150 ppm/°C
Limiting Element Voltage U_L	250 V
Dielectric Strength IEC 60115-1	2000 V_{rms} - 1 min - 10 mA max. (between terminals and board)
Insulation Resistance	≥ 10^6 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	1.79 kΩ

SPECIAL FEATURES

Resistance Values	≥ 0.010	≥ 0.045	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Requirement Temperature Coefficient (TCR) (- 55 °C + 150 °C) IEC 60115-1	± 1100 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

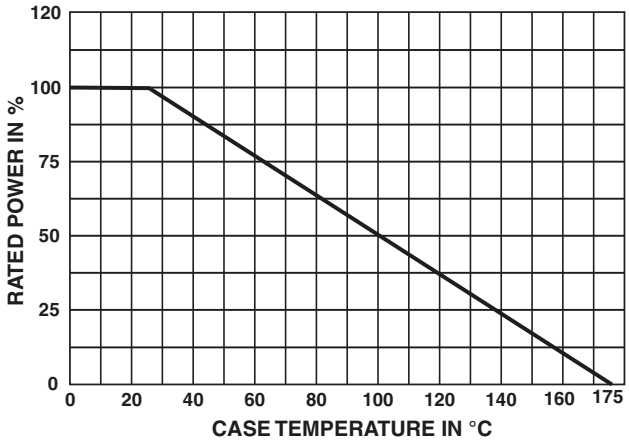
MECHANICAL SPECIFICATIONS	
Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2.2 g max.

ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	- 55 °C to 175 °C
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

DIMENSIONS	
Standard Package	TO-263 style (D^2PAK)

POWER RATING

The temperature of the case should be maintained within the limits specified.



PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 §4.13 1.7 P_r 5 s for $R < 2\ \Omega$ 1.4 P_r 5 s for $R \geq 2\ \Omega$ $U_S < 1.5\ U_L$	± (0.25 % + 0.005 Ω)
Rapid Temperature Change	IEC 60115-1 Test Na 5 cycles - 1 h - 55 °C to + 175 °C	± (0.5 % + 0.005 Ω)
Load Life	IEC 60115-1 1000 h at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	IEC 60115-1 IEC 60068-2-3 Test Ca: 56 days RH 95 %	± (0.5 % + 0.005 Ω)
Vibration	MIL STD 202 Method 204 - Test D 10 to 2000 Hz	± (0.2 % + 0.005 Ω)
Terminal Strength	IEC 60115-1 Test Ua1/Tensile: 20 N/10 s	± (0.2 % + 0.005 Ω)
Shock	IEC 60115-1 IEC 60068-2-27 Saw-tooth: 100 *gn*/6 ms	± (0.5 % + 0.005 Ω)

ASSEMBLY SPECIFICATIONS		
For the assembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Resistance to Soldering Heat	IEC 60115-1 IEC 60068-2-58 Solder bath method: 270 °C/10 s	± (0.5 % + 0.005 Ω)
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020C 85 °C/85 % RH/168 h	Level: 1 + pass requirements of TCR overload and dielectic strength after MSL

CHOISE OF THE BOARD

The user must choose the board according to the working conditions of the component (power, room temperature). Maximum working temperature must not exeed 155 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)}] + [R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: 4.28 °C/W.

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the solder layer (according the quality of the soldering) and the thermal resistance of the board.

Example:

$R_{TH\ (c-a)}$ for D2TO35 power rating 3.5 W at ambient temperature + 25 °C.

Thermal resistance $R_{TH\ (j-c)}$: 4.28 °C/W

Considering equation (1) we have:

ΔT = 175 °C - 25 °C = 150 °C

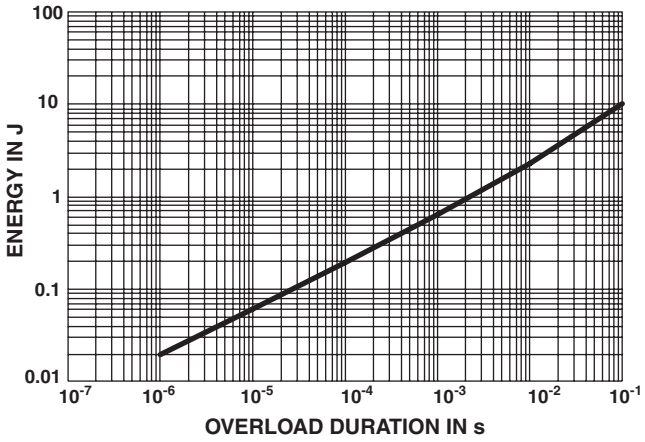
$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \Delta T/P = 150/3.5 = 42.8$ °C/W

$R_{TH\ (c-a)} = 42.8$ °C/W - 4.28 °C/W = 38.52 °C/W

ACCIDENTAL OVERLOAD

In any case the applied voltage must be lower than the maximum overload voltage of 375 V. The values indicated on the graph below are applicable to resistors in air or mounted onto a board.

ENERGY CURVE



Single Pulse:

These informations are for a single pulse on a cold resistor at 25 °C (not already used for a dissipation) and for pulses of 100 ms maximum duration.

The formula used to calculate *E* is:

$$E = P \times t = \frac{U^2}{R} \times t$$

with:

E (J): Pulse energy

P (W): Pulse power

t (s): Pulse duration

U (V): Pulse voltage

R (Ω): Resistor

The energy calculated must be less than that allowed by the graph.

Repetitive or Superimposed Pulses:

The following formula is used to calculate the “equivalent“ energy of a repetitive pulse or the “equivalent energy“ of a pulse on a resistor that is already dissipating power.

$$E_c = E \times \left(1 + \frac{P_a}{P_r}\right)$$

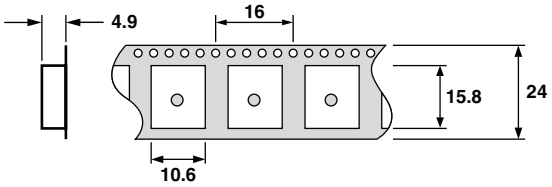
with:

E_c (J): Equivalent pulse energy
E (J): Known pulse energy
P_r: Resistor power rating
P_a: Mean power being dissipated

The energy calculated must be less than that allowed by the graph and the average power dissipated (P_a) must not exceed the continuous power of resistor.

PACKAGING

- Reel
- Tube
- Tape dimensions (mm) for reel:



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark

ORDERING INFORMATION

D2TO	35	C	100 kΩ	± 1 %	XXX	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	LEAD (Pb)-FREE
				F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 %	Optional on request: Shape, etc	

SAP PART NUMBERING GUIDELINES

D	2	T	O	0	3	5	C	R	2	0	0	0	K	R	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
D2TO	**035**	**C** = Surface mount	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**R** = Reel 500 pieces **T** = Tube 50 pieces	**E3** = Pure tin

Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35)

Vishay has completed its range of resistors using the thick film technology. After the well-known resistors RTO, LTO (TO-220 packages) for application with mounting on heatsink, three new surface mounted devices SMD resistors are now available with the same technology:

- D2TO20 (TO-263/D^{2}PAK package)
- D2TO35 (TO-263/D^{2}PAK package)

The first one model can dissipate 20 W with 25 °C case temperature. D2TO35 using the same packaging, is an improved version of D2TO20 that can dissipate till 35 W with 25 °C case temperature. Recently, another version was developed according the smaller TO-252 (DPAK) packaging. This new version can dissipate 25 W at 25 °C for the case temperature.

These three resistors offer a wide range of ohmic value, from 0.01 Ω to 1 MΩ according the model.

1. INTRODUCTION

To achieve a high reliability level and performance of the resistors, the board must be designed taking into account the thermal consideration for each component. Each electronic component has a limitation about temperature of the die or the resistive element. This maximum temperature can be 150 °C, 175 °C, …, according the model.
Moreover, it is necessary to have a minimum distance between the different components used on a board. To realise a good design of the board, it is necessary to realise some evaluations and to know the thermal environment of the component.

This document was written to help the designers during the conception of their board giving us some information about the thermal dissipation for SMD components in order to use the resistor with optimum parameters. Evaluations of the maximum power for the three resistors, D2TO20, D2TO35 were realised in our laboratory, soldered on different boards using standard parameters in electronic applications.

2. PRESENTATION OF THE MEASUREMENT

Measurements are realised with a thermal IR camera. The component is soldered on different boards using a lead-free alloy Sn/Ag.

The composition of each raw material used in these resistors was adapted to be secure with the temperature of soldering. The customer is totally secure to use lead (Pb)-free alloy for the soldering of the component on the board with the standard temperature of 240 °C to 260 °C in accordance with the RoHS directive limiting the use of the lead (Pb).

Main of our competitors are not able to propose resistors with this configuration and require to not exceed 220 °C on the case, so require to use Sn/Pb alloy. If this recommendation is not considered, the reliability of the component should decrease (dissipation, dielectric strength) due to some deteriorations of the internal soldering.

Once the resistor is soldered, the board is positioned vertically in front of the thermal IR camera. The ambient temperature during the test is 25 °C.
The voltage/power is applied on the component till reaching the maximum working temperature. After stabilization to the maximum temperature, the power is determined.

The maximum working temperatures are listed according the different models of resistor:

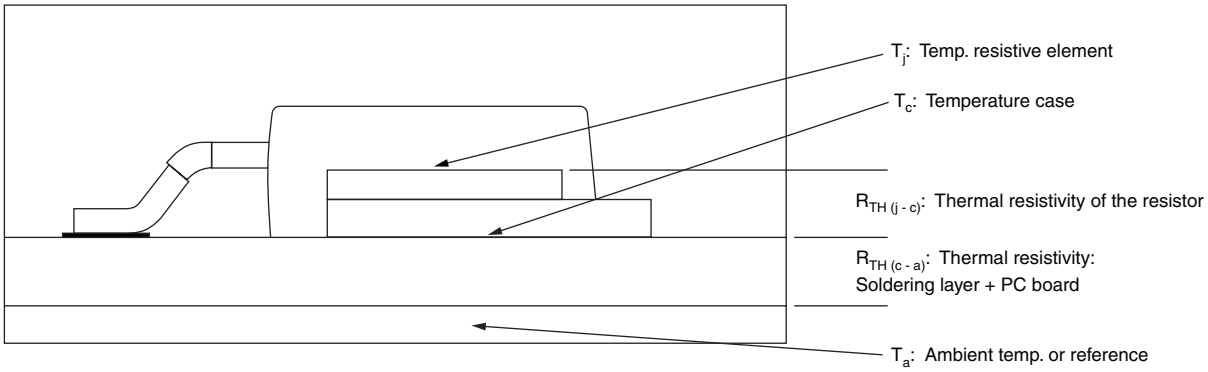
RESISTOR	MAX. WORKING TEMPERATURE OF THE RESISTIVE ELEMENT	THERMAL RESISTIVITY (RESISTIVE ELEMENT TO CASE): $R_{TH\ (j\ -\ a)}$
D2TO20	155 °C	6.5 °C/W
D2TO35	175 °C	4.28 °C/W

Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35)

The thermal resistivity is calculated using the formula:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ a)}]}$$

$R_{TH\ (j\ -\ a)}$ is the thermal resistivity of the component, of the soldering layer and of the board.
ΔT is the difference between the maximum working temperature and the room temperature (25 °C during the test).



We can easily realise a comparison between the famous “Ohm's Law” and the heat dissipation.
In this comparison, the temperature can be replaced by the voltage, the thermal resistivity can be replaced by the resistance and the power by the current. We use this model to calculate the power or to calculate the different temperatures.

In order to help you, we have measured the power applied for each different configurations “Device/PC Board”. Most of the PC board used Fr4 and this material is limited by a maximum temperature due to its glass transition temperature (Tg): 130 °C. Typically 20 °C is the safety margin that the designers used for their application.

3. THERMAL LIMITATION OF THE PC BOARD

The PC board cannot be used with a temperature higher than the glass transition temperature Tg. Higher than Tg, the characteristics of the board are deteriorated in particular for the thermal conductivity. For Fr4, this temperature is typically 125 °C to 135 °C. Engineers use often 20 °C for a safety margin.
So, we have two different limitations: The maximum working temperature of the resistor (from 150 °C to 175 °C depending on the model) and the maximum working temperature of the board (110 °C). The first limitation in most applications, is the temperature of the board.

We can use different materials for the PC board with the following glass transition temperature (Tg):

MATERIAL	Tg
Fr2	105 °C
Fr4	125 °C to 135 °C
Fr5	170 °C
Polyimide	260 °C

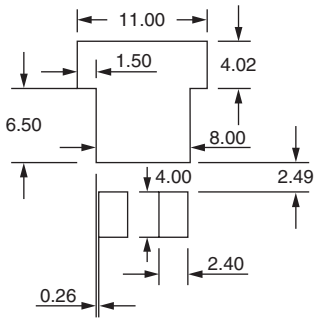
Fr4 is standard for the electronic boards because it is less expensive, but more and more engineers use Fr5 or IMS (Insulated Metal Substrate). These new materials have a more important thermal conductivity and a more important Tg (necessary due to the new lead (Pb)-free soldering process with higher temperature of soldering).

Insulated metal substrate (IMS) consists of an aluminium metal baseplate covered by a thin layer of dielectric (usually an epoxy-based layer) and a layer of copper. Due to its structure, the IMS is a single-sided substrate, it can only accommodate components on the copper side. In most applications, the baseplate is attached to a heatsink to provide cooling, usually using thermal grease and screws. Some IMS substrates are available with a copper baseplate for better thermal performances.

Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35)

4. PRESENTATION OF THE SOLDERING PAD FOR D2TO

We recommend the minimum footprints for the solderable contact area:



Soldering Pad D2TO

5. RESULTS OF THE MEASUREMENTS

RESISTOR	PC BOARD	DIM. OF PC BOARD (mm)	THICKNESS OF COPPER LAYER (µm)	SINGLE/DOUBLE SIDED COPPER BOARD	SOLDER PAD SURFACE ($Inch^2$)	TEMP. OF RESISTIVE ELEMENT (°C)	POWER APPLIED (W)
D2TO20	Fr5	39 x 30 x 1.6	70	Double	-	155	3.1
D2TO35						175	3.6

6. HOW TO INCREASE THE DISSIPATION ON A PC BOARD?

The PC board are not very efficient for the heat dissipation: The thermal resistivity can be typically 20 °C/W to 100 °C/W. For this reason, the board is often the limiting element for the dissipation of the component on the board.

For the example of a thermal resistivity for the board of 35 °C/W and if we use a limitation of 110 °C, the power that can be used on the board is:

- $P = (T_{Fr4} - T_{amb})/R_{TH}$
- $P = (110 - 25)/35$
- $P = 2.42$ W

If we apply 2.42 W on D2TO35, we know that the thermal resistivity of this resistor is 4.28 °C/W, for T_{Fr4} = 110 °C on the board, we can calculate the temperature of the resistive element:

$T_{Res.} - T_{Fr4} = P \times R_{TH} = 2.42 \times 4.28 = 10.4$

$T_{Res.} = 10.4 + 110$

$T_{Res.} = 120.4$ °C

The working temperature of the resistor will be 122.1 °C instead of 150 °C possible for this type of component.

Since the application of the european directive “RoHS” in July 2006 for the restriction of the use of certain hazardous substances like lead, another type of PC board “Fr” is more and more used: Fr5. The Tg of this material is near 175 °C, so the limitation is now on the resistive element and not on the PC board: For example, D2TO35 can be used with the maximum working temperature (175 °C on the resistive element).

Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35)

To increase the power dissipation on the Pc board, many parameters can be changed :

- The **dimensions of the PC board** are obviously an important parameter for the dissipation.
- Some **materials have a more important capacity to dissipate the heat:** Thermal resistivity of IMS (Insulated Metal Substrate) can decrease to 10 °C/W. This type of board is typically the superposition of a copper layer (70 µm typically), of a dielectric layer (150 µm) and an aluminium layer (1.5 mm). This material can be used with a more important working temperature than Fr4. With this material the limitation for the power will be the resistor and not the board.
- Designers can also **increase the surface of copper used for the soldering pad** (for the case or for the leads), due to the good thermal conductivity of this material.
- The **thickness of the copper layer** is also important.
- Some special **heatsink for SMD** can be glued on the component or near the component on the board. With this solution, you can multiply the power by 3.
- **Thermal vias** are pads with plated holes using copper that carry heat away from power resistor to the other side of the board using also a copper layer. Thermal vias are only possible with double sided copper board. The holes are made conductive typically using copper by electroplating.
  It is recommended to use thermal vias as close as possible to the device. These vias can be used directly on the solder pad below the device to improve the dissipation.
- The **position of the board** (vertical or horizontal) is also a parameter that can impact on the dissipation.
- The **quality of the soldering layer** between device and board is also important. Voids in this layer are not good for the thermal dissipation. The parameters used for the soldering process, temperature, preheating time, …, are to be tested to achieve the best dissipation.

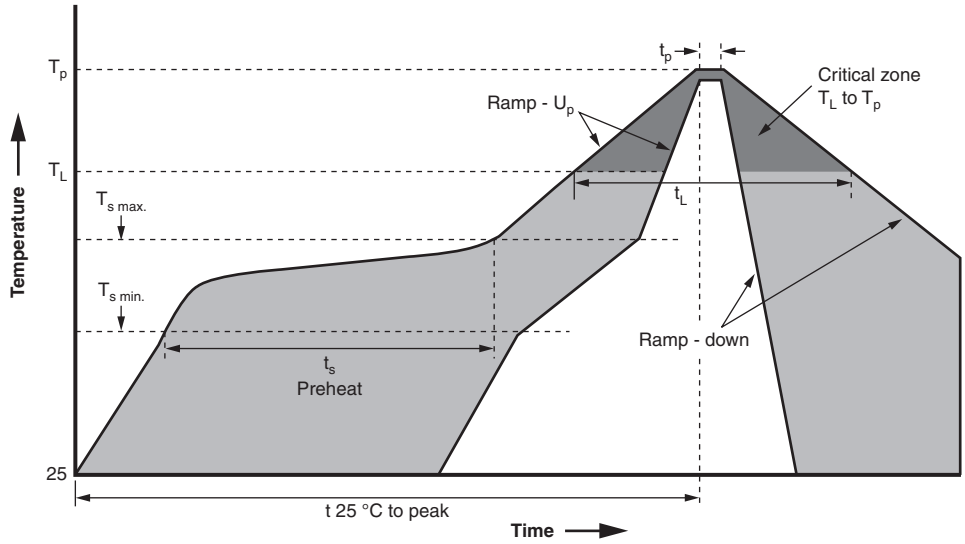
7. SOME RECOMMENDATIONS ABOUT THE SOLDERING OF THE SMD COMPONENTS ON THE PC BOARD

The main advantage of the SMD range resistors produced by Vishay is the possibility to use soldering temperature of 270 °C, contrary to most of our competitors. The customer can solder the D2TO resistors using SnPb process (typically 210 °C to 230 °C) or using RoHS process with SnAg and (typically 250 °C to 260 °C).
We recommend by the way to use the thermal profile indicated in the JEDEC norm J-STD-020C in order to obtain the most reliable solder possible.

PROFILE FEATURE	SnPb EUTECTIC ASSEMBLY	LEAD (Pb)-FREE ASSEMBLY
Average Ramp - U_p rate ($T_{s\ max.}$ to T_p)	3 °C/s max.	3 °C/s max.
Preheat - Temperature min. ($T_{s\ min.}$) - Temperature max. ($T_{s\ max.}$) - Time ($t_{s\ min.}$ to $t_{s\ max.}$)	 100 °C 15 °C 60 s to 120 s	 150 °C 200 °C 60 s to 180 s
Time maintained above: - Temperature (T_L) - Time (t_L)	 183 °C 60 s to 150 s	 217 °C 60 s to 150 s
Peak/classification temperature (T_p)	See table 4.1	See table 4.2
Time within 5 °C of actual peak temperature (t_p)	10 s to 30 s	20 s to 40 s
Ramp - down rate	6 °C/s max.	6 °C/s max.
Time 25 °C to peak temperature	6 min max.	8 min max.

Note
- All temperatures refer to topside of the package, measured on the package body surface

Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35)



Reminder: Maximum temperature during soldering process of the resistor: 300 °C on the resistor.

7. MOISTURE SENSITIVITY LEVEL

Moisture Sensitivity Level (MSL) related to the packaging and handling precautions. During the storage of the device, humidity can be absorbed inside the molding element. Devices are more and more smaller. These smaller devices can be damaged during reflow when moisture trapped inside the component expands. This internal package stress can create some cracks or delaminations in the device. This is known as the “popcorn” effect. Most of this damage is not visible on the component surface. In extreme cases, cracks will extend to the component surface.

IPC/JEDEC has defined a standard classification of moisture sensitivity levels (MSL). MSL are expressed in numbers, with the MSL number increasing with the vulnerability of the package to popcorn cracking. Thus, MSL1 correspond to packages that are immune to popcorn cracking regardless of exposure to moisture, while MSL5 and MSL6 devices are most prone to moisture-induced fracture.

Table 1 below presents the MSL definitions per IPC/JEDEC's J-STD-20.

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS			
			Standard		Accelerated	
	Time	Cond °C/%RH	Time (h)	Cond °C/%RH	Time (h)	Cond °C/%RH
1	Unlimited	≤ 30/85 %	168 + 5/- 0	85/85	n/a	n/a
2	1 year	≤ 30/60 %	168 + 5/- 0	85/60	n/a	n/a
2a	4 weeks	≤ 30/60 %	696 + 5/- 0	30/60	120 + 1/- 0	60/60
3	168 h	≤ 30/60 %	192 + 5/- 0	30/60	40 + 1/- 0	60/60
4	72 h	≤ 30/60 %	96 + 2/- 0	30/60	20 + 0.5/- 0	60/60
5	48 h	≤ 30/60 %	72 + 2/- 0	30/60	15 + 0.5/- 0	60/60
5a	24 h	≤ 30/60 %	48 + 2/- 0	30/60	10 + 0.5/- 0	60/60
6	Tol.	≤ 30/60 %	Tol.	30/60	n/a	60/60

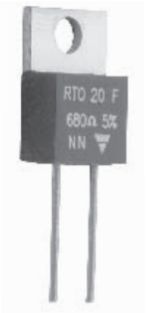
After this storage, devices are reflowed three times and finally observed by X-Ray analysis to check some cracks or delamination appearance.

For D2TO20, D2TO35: No drift, no crack, no delamination with the most severe conditions: MSL = 1.

Heatsink Mounting And Through Hole Thick Film Power Resistors

Contents

20 W Power Resistor, Thick Film Technology, TO-220



The well known TO-220 package is compact and easy to mount.

FEATURES

- 20 W at 25 °C heatsink mounted
- High power dissipation to size ratio
- Wide resistance range from 0.01 Ω to 550 kΩ
- Negligible inductance
- Easy mounting
- TO-220 package: Compact and easy to mount
- Compliant to RoHS directive 2002/95/EC

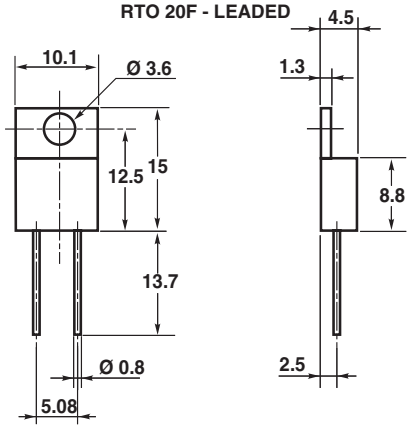
RoHS COMPLIANT

Two versions of this thick film resistor are available:

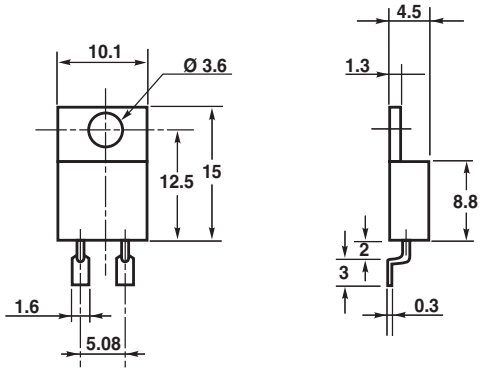
- A radial leaded version for PCB mounting
- A flat lead version for surface mounting

DIMENSIONS in millimeters

RTO 20F - LEADED



RTO 20C - FOR SURFACE MOUNTING



• Only for RTO 20 version C = during surface mount soldering temperature profile must not cause the metal tab of this device to exceed 220 °C.

Note

• Tolerance unless otherwise specified: ± 0.4 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Resistive Element	Thick film
Connections	Tinned copper
Weight	2.2 g max.

DIMENSIONS

Standard Package	TO-220 Insulated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/155/56
Sealing	Sealed container Solder immersion
Flammability	IEC 60695-11-5 2 applications 30 s seperated by 60 s

Note

• Not compatible with RoHS reflow profile

ELECTRICAL SPECIFICATIONS

Resistance Range	0.010 Ω to 550 kΩ serie E24
Tolerances (Standard)	± 1 % to ± 10 %
Dissipation and Associated:	Onto a heatsink
Thermal Resistance and Nominal Power	20 W at + 25 °C $R_{TH\ (j\ -\ c)}$: 6.5 °C/W free air: 2 W at + 25 °C
Temperature Coefficient Standard (- 55 °C; + 150 °C)	See Performance table ± 150 ppm/°C
Limiting Element Voltage U_L	250 V
Dielectric Strength MIL STD 202	2000 V_{RMS} - 1 min - 10 mA max. (between terminals and heatsink)
Insulation Resistance	≥ 10^6 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	3.12 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 2 P_r 5 s for R < 2 Ω 1.6 P_r 5 s for R ≥ 2 Ω U_S < 1.5 U_L	± (0.25 % + 0.005 Ω)
Rapid Temperature Change	EN 60115-1/60068-2-14 5 cycles - 55 °C to + 155 °C	± (0.5 % + 0.005 Ω)
Load Life	EN 60115-1 1000 h P_r at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	EN 60115-1 56 days R.H. 95 %	± (0.5 % + 0.005 Ω)
High Temperature Exposure	NF EN 140 000 1000 h - 40 % P_r at + 100 °C	± (0.5 % + 0.005 Ω)
Vibration	MIL STD 202, Method 204 C Test D	± (0.2 % + 0.005 Ω)
Terminal Strength	MIL STD 202, Method 211 Test A1	± (0.2 % + 0.005 Ω)
Shock	IEC 60115-1 IEC 60068-2-27 Saw tooth: 100 *g*/6 ms	± (0.5 % + 0.005 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR				
Resistance Values	≥ 0.01	≥ 0.015	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Typical Temperature Coefficient Range (- 55 °C to + 155 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

Note

- For very low ohmic values, TCR for information

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).

Maximum working temperature must not exceed 155 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (Special Features table)

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$: For RTO 20 power rating 10 W at ambient temperature + 25 °C

Thermal resistance $R_{TH\ (j-c)}$: 6.5 °C/W

Considering equation (1) we have:

ΔT = 155 °C - 25 °C = 130 °C

$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{130}{10} = 13\ °C/W$$

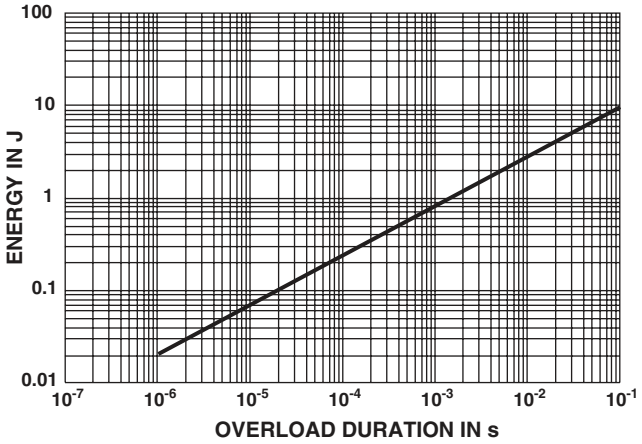
$R_{TH\ (c-a)}$ = 13 °C/W - 6.5 °C/W = 6.5 °C/W

OVERLOADS

In any case the applied voltage must be lower than the maximum overload voltage of 375 V.

The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

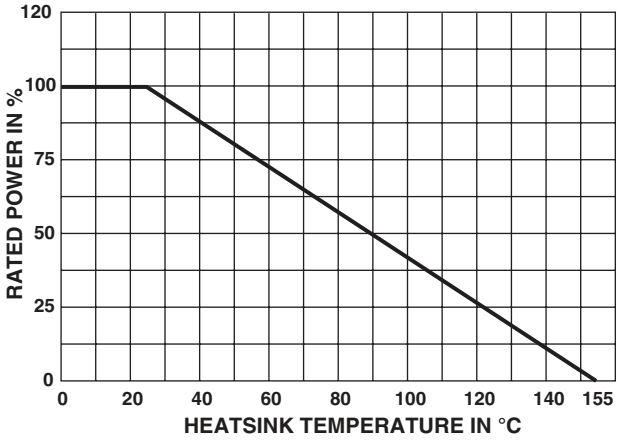
ENERGY CURVE



POWER RATING

The temperature of the heatsink should be maintained within the limits specified.

To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm. Spring clip can also be used to mount the component on an heatsink (ex: Kunze, clip KU4-498).



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Tube of 50 units

ORDERING INFORMATION

RTO	20	F	U68	5 %	xxx	TU50	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
		F: Radial leads C: Surface mount		± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: Special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

R	T	O	0	2	0	F	R	6	8	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING
RTO	**020**	**F** = Radial leads **C** = Surface mount	The firts four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Size 30 and 50: Tube 50 pieces

50 W Power Resistor, Thick Film Technology, TO-220

FEATURE

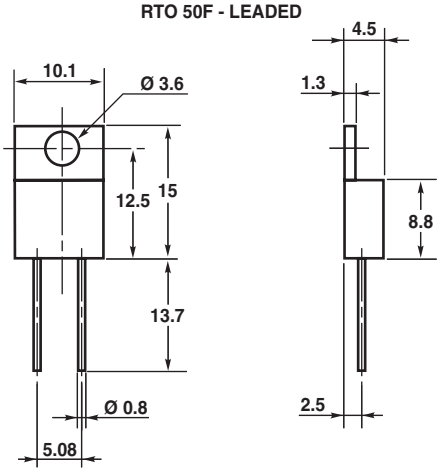
- 50 W at 25 °C heatsink mounted
- Adjusted by sand trimming
- Leaded or surface mount versions
- High power to size ratio
- Non inductive element
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

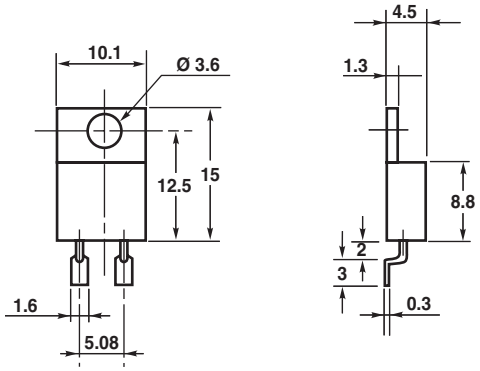
Because of the knowledge and experience in Thick Film technology, Vishay Sfernice has been able to develop a high power resistor in a TO-220 package called RTO 50. The special design of this component allows the dissipation of 50 W when mounted on a heatsink. The ohmic value is adjusted by sand trimming. This process does not generate hot spots as in laser trimming, which could lead to microcracks on each side of the curve. This process improves the reliability and the stability of the resistor and at the same time gives a good overload capability.

DIMENSIONS in millimeters

RTO 50F - LEADED



RTO 50C - FOR SURFACE MOUNTING



• Only for RTO 50 version C = during surface mount soldering, the soldering temperature profile must not cause the metal tab of this device to exceed 220 °C.

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Connections	Tinned copper alloy
Weight	2.2 g max.

DIMENSIONS

Standard Package	TO-220 Insulated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/155/156
Sealing	Sealed container Solder immersion
Flammability	IEC 60695-11-5 2 applications 30 s seperated by 60 s

Note
• Not compatible with RoHS reflow profile

ELECTRICAL SPECIFICATIONS

Resistance Range	0.010 Ω to 550 kΩ serie E24
Tolerances Standard	± 1 % to ± 10 %
Dissipation and Associated	Onto a heatsink
Thermal Resistance and Nominal Power	50 W at + 25 °C $R_{TH\ (j-c)}$: 2.6 °C/W free air: 2.25 W at + 25 °C
Temperature Coefficient Standard (- 55 °C; + 150 °C)	See Performance table ± 150 ppm/°C
Limiting Element Voltage U_L	300 V
Dielectric Strength MIL STD 202 (301)	2000 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^6 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	1.8 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 2 Pr 5 s for R < 2 Ω 1.6 Pr 5 s for R ≥ 2 Ω $U_S < 1.5\ U_L$	± (0.25 % + 0.05 Ω)
Rapid Temperature Change	EN 60115-1 60 068-2-14 5 cycles - 55 °C to + 155 °C	± (0.5 % + 0.05 Ω)
Load Life	EN 60115-1 P_r at + 25 °C, 1000 h CEI 115_1	± (1 % + 0.05 Ω)
Humidity (Steady State)	EN 60115-1 56 days RH 95 %	± (0.5 % + 0.05 Ω)
Vibration	MIL STD 202 Method 204 C Test D	± (0.2 % + 0.05 Ω)
Terminal Strength	MIL STD 202 Method 211 Test A1	± (0.2 % + 0.05 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR				
Resistance Values	≥ 0.01 Ω	≥ 0.015 Ω	≥ 0.1 Ω	≥ 0.5 Ω
Tolerances	± 1 % at ± 10 %			
Temperature Coefficient Standard (- 55 °C to + 155 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).

Maximum working temperature must not exceed 155 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (Special Features Table)

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device

Example:

$R_{TH\ (c-a)}$: For RTO 50 power rating 13 W at ambient temperature + 30 °C

Thermal resistance $R_{TH\ (j-c)}$: 26 °C/W

Considering equation (1) we have:

$$\Delta T \leq 155\ °C - 30\ °C \leq 125\ °C$$

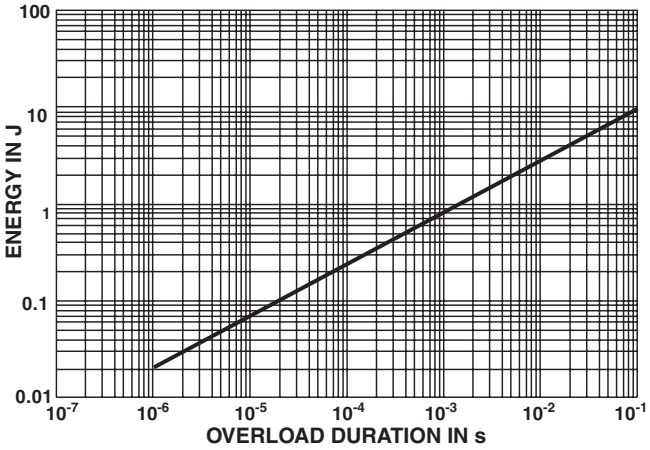
$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{125}{13} = 9.6\ °C/W$$

$$R_{TH\ (c-a)} \leq 9.6\ °C/W - 2.6\ °C/W \leq 7\ °C/W$$

OVERLOADS

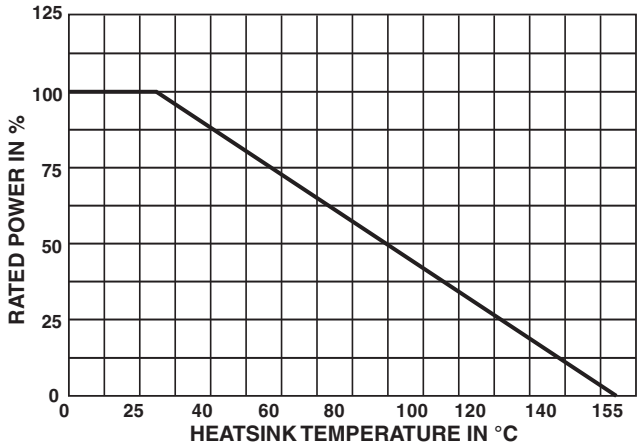
The applied voltage must always be lower than the maximum overload voltage of 450 V.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING

The temperature of the heatsink should be maintained within the limits specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Tube of 50 units

ORDERING INFORMATION

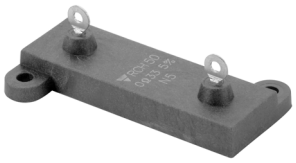
RTO	50	F	100K	± 1%	XXX	TU50	e1
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
		F: Radial leads C: Surface mount		± 1% ± 2% ± 5% ± 10%	Optional on request: Special TCR, shap, etc.		

GLOBAL PART NUMBER INFORMATION

R	T	O	0	5	0	F	R	6	8	0	0	J	T	E	1

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING
RTO	**050**	**F** = Radial leads **C** = Surface mount	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Size 30 and 50: Tube 50 pieces

Power Resistor, for Mounting onto a Heatsink Thick Film Technology



FEATURES

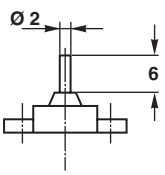
- 5 W to 50 W
- High power rating
- High overload capabilities up to 2500 V_{RMS}
- Wide resistance range from 0.24 MΩ to 1 MΩ
- High thermal capacity up to 0.8 °C/W
- Easy mounting
- Reduced size and weight
- High insulation: 10^6 MΩ
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

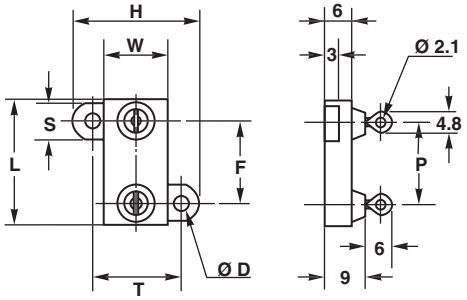
Manufactured in cermet thick film technology, these power resistors exhibit remarkable characteristics and the series includes 4 types ranging from 5 W to 50 W.
Designed to be mounted onto a heatsink, the resistors can bear high short time overloads and 3 types of terminations are available.
The resistors are non inductive and are particularly suitable for high frequency operation and cut-out circuits.

DIMENSIONS in millimeters

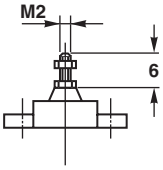
RCH...R



RCH...S



RCH...V



General tolerance: ± 0.3 mm

SERIES	L	W	P LAEDS PITCH	F CONNECTION PITCH	T	S	Ø D	SCREW NOT SUPPLIED	WEIGHT g
RCH5	16.6	9	16.4	10.2	11.3	12.5	5.3	2.4 M2	4
RCH10	19	11	20.6	12.7	14.3	15.9	5	2.4 M2	5
RCH25	28	14	27.5	18.3	18.3	19.8	7.7	3.2 M3	7
RCH50	47.8	15.5	29.4	30.5	39.7	21.4	8	3.2 M3	12

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina
Resistive Element	Cermet
Connections	Tinned copper alloy

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56

ELECTRICAL RSPECIFICATIONS	
Resistance Range	0.24 Ω to 1 MΩ E24 series
Standard Resistance Tolerances	± 1 %, ± 2 %, ± 5 %, ± 10 %
Power Rating: **Chassis Mounted**	5 W to 50 W
Unmounted	2 W to 5.5 W
Temperature Coefficient	± 150 ppm/°C (R > 1 Ω)
Insulation Resistance	10^6 MΩ
Total Inductance	≤ 0.1 µH

PERFORMANCE		
TESTS	**CONDITIONS**	**TYPICAL DRIFTS**
Momentary Overload	NF EN140000 CEI 115_1 2 P_r/5 s U_S < 2 U_L	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	NF EN140000 125 °C CEI 68215 Test Na 5 cycles - 55 °C to + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life	NF EN140000 CEI 115_1 1000 h P_r at + 25 °C	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	56 days RH 95 % MIL-STD-202 Method 103 B and C	< ± (0.5 % + 0.05 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR		
Resistance Value	< 1 Ω	> 1 Ω
Standard Tolerances	± 5 % ± 10 %	
Standard TCR	± 250 ppm/°C	± 150 ppm/°C
Tolerance on Request	± 1 % to ± 2 %	

SPECIAL FEATURES				
MODEL	**RCH5**	**RCH10**	**RCH25**	**RCH50**
Power Rating-Chassis Mounted	5 W	10 W	25 W	50 W
Power Rating-Unmounted	2 W	2.5 W	4 W	5.5 W
Thermal Resistance $R_{TH\ (j-c)}$	4.8 °C/W	3.2 °C/W	1.4 °C/W	0.8 °C/W
Limiting Element Voltage (V_{RMS})	160 V	250 V	550 V	1285 V
Max. Overload Voltage (V_{RMS})	320 V	500 V	1100 V	2500 V
Dielectric Strength (V_{RMS}) 50 Hz, 1 min MIL-STD-202 Method 301 10 mA Max.	2000 V	2000 V	3500 V	3500 V
Critical Resistance	5120 Ω	6250 Ω	12 100 Ω	33 024 Ω

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) are coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of two screws (not supplied).

Tightening Torque on heatsink	RCH5	RCH10	RCH25	RCH50
	0.5 Nm	0.6 Nm	0.7 Nm	1 Nm

- In order to improve the dissipation, either forced-air cooling or liquid cooling may be used.
- A low thermal radiation of the case allows several resistors to be mounted onto the same heatsink.
- Do not forget to respect an insulation value between two resistors (dielectric strength in dry air 1 kV/mm).
- In any case the hot spot temperature, measured locally on the case must not exceed 125 °C.
- Tests should be performed by the user.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to working conditions of the component (power, room temperature). Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature.

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistance layer and outer side of the resistor.
It is the thermal resistance of the component (See Special Features table).

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature.
It is the thermal resistance of the heatsink depending on the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$: For RCH 25 power rating 20 W at ambient temperature + 50 °C.

$\Delta T \leq 125\ °C - 50\ °C \leq 75\ °C$

$R_{TH\ (j-c)} = 1.4\ °C/W$ (Special Features)

$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{75}{20} = 3.75\ °C/W$

$R_{TH\ (c-a)} \leq 3.75\ °C/W - 1.4\ °C/W \leq 2.35\ °C/W$

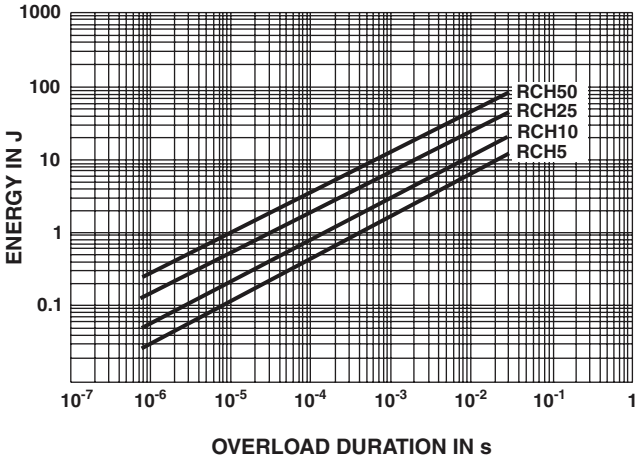
OVERLOADS

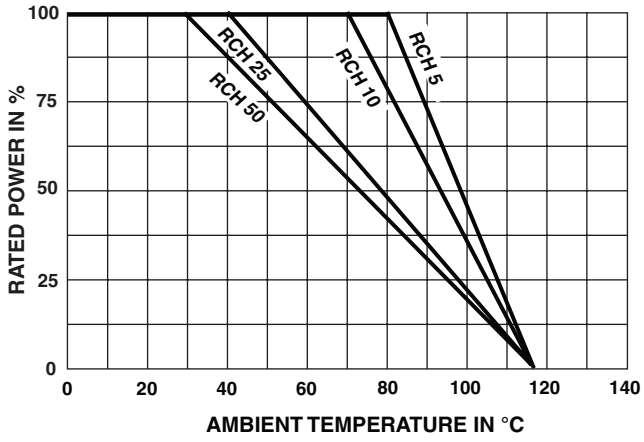
The applied voltage must always be lower than the maximum overload voltage as shown in the special features table.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

POWER RATING

For resistors mounted onto heatsink and thermal resistance of 1 °C/W.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease.

ENERGY CURVE





MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

ORDERING INFORMATION

RCH	25	3.3 kΩ	± 5 %	R	XXX
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE	CONNECTIONS	CUSTOM DESIGN
			Optional ± 1 % ± 2 % ± 5 % ± 10 %	Optional S: Flat with hole R: Round lead V: M2 screw	Optional

GLOBAL PART NUMBER INFORMATION

R	C	H	1	0	S	3	3	0	0	0	J	S	0	6	

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RCH	**05** **10** **25** **50**	**R** = Round lead **V** = M2 screw **S** = Flat with hole	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **4R700** = 4.7 Ω **48701** = 48 700 Ω **33000** = 33 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**S06** = Bag 25 pieces	As applicable Ex = **XXX**

LCH 100

Vishay Sfernice

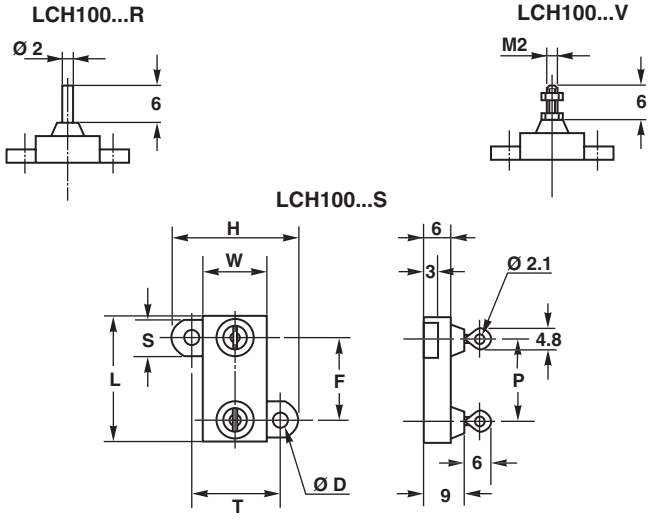
Power Resistor, for Mounting onto a Heatsink
Thick Film Technology

FEATURES

- 100 W at 25 °C case temperature
- High power rating
- High overload capabilities up to 2500 V_{RMS}
- Wide resistance range from 0.06 Ω to 1 MΩ
- High thermal capacity up to 1 °C/W
- Easy mounting
- Reduced size and weight
- High insulation: 10^6 MΩ
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS



MODEL	LCH 100
L	47.8
W	15.5
H	29.4
P Leads Pitch	30.5
F Connections Pitch	39.7
T	21.4
S	8
Ø D	3.2
V Leads	M3
Weight (g)	12

Note
• General tolerance: ± 0.3 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina
Resistive Element	Cermet
Connections	Tinned copper alloy

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.06 Ω to 1 MΩ E24 series
Standard Resistance Tolerances	± 1 % to ± 10 % From 0.06 Ω to 1 MΩ only ± 5 % and ± 10 % available
Power Rating	100 W (25 °C case temperature)
Chassis Mounted	
Temperature Coefficient	± 150 ppm/°C (R > 1 Ω) - 55 °C/+ 125 °C
Insulation Resistance	10^6 MΩ
Total Inductance	≤ 0.1 µH

For technical questions, contact: sfer@vishay.com

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 2 P_r/5 s $U_S < 2\ U_L$	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1 125 °C CEI 68215 Test Na 5 cycles - 55 °C to + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life	IEC 60115-1 90' on/30' off 1000 h P_r at + 25 °C	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1 IEC 60068-2-3 Test Ca 56 days RH 95 % MIL-STD-202 Method 103 B and C	< ± (0.5 % + 0.05 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR		
Resistance Value	< 1 Ω	> 1 Ω
Standard Tolerances	± 5 % ± 10 %	
Standard TCR IEC 60115-1 - 55 °C/+ 125 °C	± 450 ppm/°C	± 150 ppm/°C
Tolerance on Request	± 1 % to ± 2 % (only for R > 1 Ω to 1 MΩ)	

SPECIAL FEATURES	
MODEL	**LCH 100**
Power Rating-Chassis Mounted	100 W (25 °C case temp.)
Thermal Resistance R_{TH} (j - c)	1 °C/W
Limiting Element Voltage (V_{RMS})	1285 V
Max. Overload Voltage (V_{RMS})	2500 V
Dielectric Strength (V_{RMS}) 50 Hz, 1 min MIL-STD-202 Method 301 10 mA Max.	3500 V
Critical Resistance	16 512 Ω

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: from 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heat-sink) are coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of two screws (not supplied).

Tightening Torque on Heatsink	LCH 100
	1 Nm

- In order to improve the dissipation, either forced-air cooling or liquid cooling may be used.
- A low thermal radiation of the case allows several resistors to be mounted onto the same heatsink.
- Do not forget to respect an insulation value between two resistors (dielectric strength in dry air 1 kV/mm).
- In any case the hot spot temperature, measured locally on the case must not exceed 125 °C.
- Tests should be performed by the user.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to working conditions of the component (power, room temperature). Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature.

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistance layer and outer side of the resistor.
It is the thermal resistance of the component (See Special Features table).

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature.
It is the thermal resistance of the heatsink depending on the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$: For LCH 100 power rating 20 W at ambient temperature + 50 °C.

$\Delta T \leq 125\ °C - 50\ °C \leq 75\ °C$

$R_{TH\ (j-c)} = 1\ °C/W$ (Special Features)

$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{75}{20} = 3.75\ °C/W$

$R_{TH\ (c-a)} \leq 3.75\ °C/W - 1\ °C/W \leq 2.75\ °C/W$

Power Resistor, for Mounting onto a Heatsink
Thick Film Technology

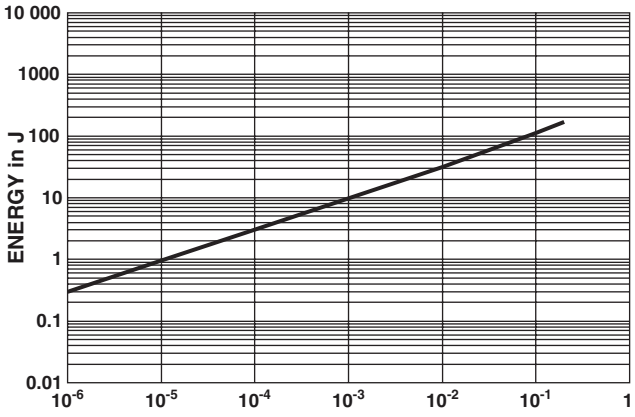
OVERLOADS

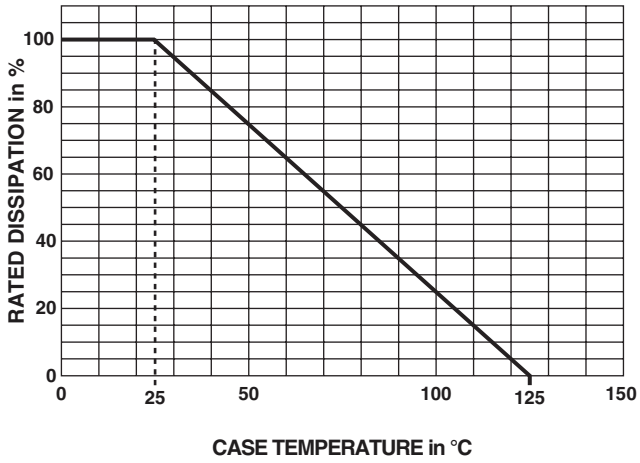
The applied voltage must always be lower than the maximum overload voltage as shown in the special features table.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

POWER RATING

For resistors mounted onto heatsink and thermal resistance of 1 °C/W.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease.

ENERGY CURVE





MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

ORDERING INFORMATION

LCH	100	3.3 kΩ	± 5 %	R	XXX
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE Optional ± 1 % ± 2 % ± 5 % ± 10 %	CONNECTIONS Optional S: Flat with hole R: Round lead V: M2 screw	CUSTOM DESIGN Optional

GLOBAL PART NUMBER INFORMATION

L	C	H	1	0	0	R	4	8	7	0	1	J	S	0	6	

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
LCH	**100**	**R** = Round lead **V** = M2 screw **S** = Flat with hole	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **4R700** = 4.7 Ω **48701** = 48 700 Ω **33000** = 3.3 kΩ **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**S06** = Bag 25 pieces	As applicable Ex = **XXX**

Power Resistor for Mounting onto a Heatsink Thick Film Technology

FEATURES

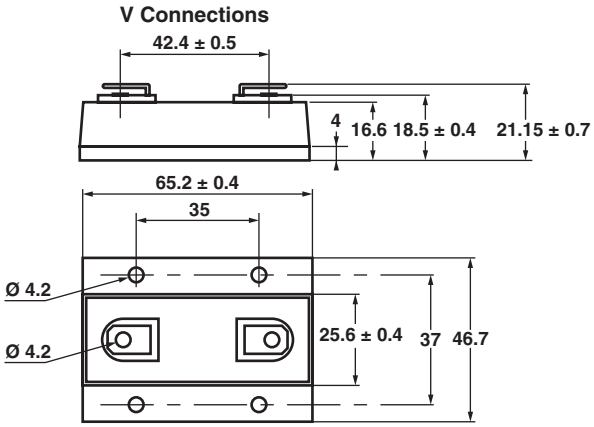
- High power rating
- Low thermal radiation of the case
- Wide ohmic value range
- Easy mounting
- High overload capabilities
- Reduced size and weight
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

This new style has been developed as an extension to RCH range. Through the use of thick film technology, a non-inductive solution for power resistors is available which are rated up to 100 W at + 25 °C. The terminations position prevents any risk of an electrical arc to the heatsink. This resistor series can replace and offer advantages to standard wirewound devices.

DIMENSIONS in millimeters

RPH 100



Note

• Tolerance unless otherwise specified: ± 0.3 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina on metallic base of nickel coated aluminum
Resistive Element	Cermet
End Connections	V connections: Screws M4 x 6
Tightening Torque Connections	1 Nm
Tightening Torque Heatsink	3 Nm
Weight	60 g

ENVIRONMENTAL SPECIFICATIONS

Thermal Resistance	$R_{TH\ (j-c)}$ 0.55 °C/W
Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.092 Ω to 1 MΩ E24 series
Tolerances	± 1 % to ± 10 %
Power Rating:	
Continuous	100 W at 25 °C chassis mounted 0.45 °C/W 10 W at 25 °C free air
Momentary	400 W at 25 °C for 5 s
Temperature Coefficient Standard	± 300 ppm/°C < 1 Ω ± 150 ppm/°C > 1 Ω
Limiting Element Voltage U_L	1900 V_{RMS}
Dielectric Strength MIL STD 202	5 kV_{RMS} 1 min 10 mA max.
Insulation Resistance	> 10^6 MΩ
Inductance	< 0.1 µH

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Short Time Overload	NF EN 140000 CEI 115_1 4 P_n/5 s $U_S < 2\ U_L$	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	NF EN 140000 CEI 68214 Test Na 5 cycles - 55 °C + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life (Chassis Mounted 0.45 °C/W)	NF EN 140000 P_n at 25 °C 1000 h	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	MIL STD 202 Method 103 B Test D 56 days 95 % RH	< ± (0.5 % + 0.05 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR		
Ohmic Value	< 1 Ω	> 1 Ω
Standard Tolerance	± 5 %	± 5 %
Standard TCR	± 300 ppm/°C	± 150 ppm/°C
Tolerance On Request	± 1 % - ± 2 %	

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of four screws (not supplied).

Tightening Torque on Heatsink	RPH 100
	3 Nm

- In order to improve the dissipation, either forced-air cooling or liquid cooling may be used.
- Do not forget to respect an insulation value between two resistors (dielectric strength in dry air 1 kV/mm).

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratios:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)}]} \quad (1)$$

P: Expressed in W
T: Difference between maximum working temperature and room temperature.
$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor.
It is the thermal resistance of the component: 0.55 °C/W.
$R_{TH\ (c\ -\ a)}$: Thermal resistance value measured between outer side of the resistor and room temperature.
It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c\ -\ a)}$: For RPH 100 power rating 80 W at ambient temperature + 40 °C.

Thermal resistance $R_{TH\ (j\ -\ c)}$: 0.55 °C/W

Considering equation (1) we have:

$$\Delta T \leq 125\ °C - 40\ °C \leq 85\ °C$$

$$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)} = \frac{\Delta T}{P} = \frac{85}{80} = 1.06\ °C/W$$

$$R_{TH\ (c\ -\ a)} \leq 1.06\ °C/W - 0.55\ °C/W \leq 0.51\ °C/W$$

OVERLOADS

In any case the applied voltage must be lower than 2 U_n. $U_{max.} < 2\ U_n < 3800$ V.

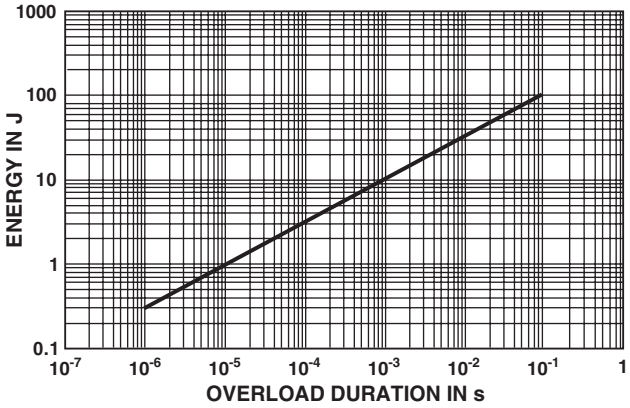
Short time overload: 4 P_n/5 s.

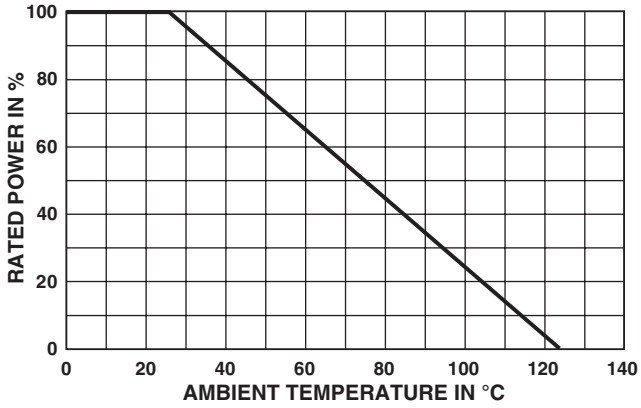
Accidental overload: The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

POWER RATING

For resistor mounted onto a heatsink with thermal resistance of 0.45 °C/W.

ENERGY CURVE





MARKING

Series, style, ohmic value (in Ω). tolerance (in %), manufacturing date, Vishay Sfernice trademark.

ORDERING INFORMATION

RPH	100	3.3 kΩ	± 5 %	V	XXX
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE	CONNECTIONS	CUSTOM DESIGN
			Optional ± 1 % ± 2 % ± 5 %	V: M4 screw	Options on request TCR, shape, etc.

GLOBAL PART NUMBER INFORMATION

R	P	H	1	0	0	V	1	0	0	0	2	J	B	

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RPH	**100**	**V** = M4 screw	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 kΩ **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 5 pieces	As applicable Ex = **XXX**

Power Resistor for Mounting onto a Heatsink Thick Film Technology

FEATURES

- 1 % tolerance available
- High power rating = 200 W
- Wide ohmic value range = 0.046 Ω to 1 MΩ
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Standard Isotop case (SOT-227 B)
- Compliant to RoHS directive 2002/95/EC

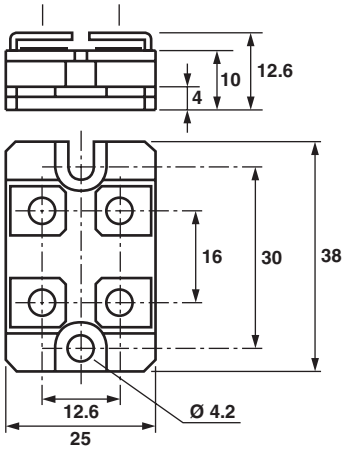
RoHS COMPLIANT

This series of thick film power resistors include modules which can incorporate up to 2 different resistor values in the same SOT-227B package. Two types of terminations are available along with a 4 terminal device for measurement applications in the case of the single resistor version. This product range benefits from Vishay Sfernice's experience in thick film power resistor technology i.e. high power: volume ratio, low tolerance or individual resistors and excellent overload capabilities (due to the trimming technique).

DIMENSIONS in millimeters

RTOP

V Connections



Note

• Tolerances unless otherwise specified: ± 0.3 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina on insulated base
Resistive Element	Cermet
End Connections	V connections: screw M4 x 6
Tightening Torque Connections	1 Nm
Tightening Torque Heatsink	2 Nm
Weight	30 g max.

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56

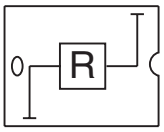
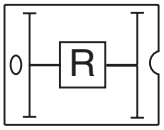
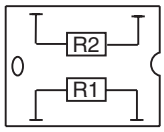
ELECTRICAL SPECIFICATIONS

Resistance Range		0.046 Ω to 1 MΩ
Standard Tolerance		± 1 % to ± 10 %
Power Rating		50 W to 200 W at + 25 °C
Temperature Coefficient (- 55 °C to + 125 °C)	**Standard**	± 300 ppm/°C (R < 1) ± 150 ppm/°C (R > 1)
Insulation Resistance		> 10^6 MΩ

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS
Momentary Overload	IEC 60115-1 2.5 P_n/5 s U_S < 2 U_L	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1 5 cycles - 55 °C + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life	IEC 60115-1 P_n at 25 °C 1000 h	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1/IEC 60068-2-3 Test Ca 56 days 95 % R.H./40 °C	< ± (0.5 % + 0.05 Ω)

SPECIAL FEATURES

MODEL	RTOP 200	RTOP 100	DRTOP 100	DRTOP 50
Power Rating at + 25 °C **Chassis Mounted Resistors** **Unmounted Resistors**	 200 W 5 W	 100 W 5 W	 100 W 3.5 W	 50 W 3.5 W
Thermal Resistance (Per Resistor)	0.5 °C/W	1 °C/W	0.5 °C/W	1 °C/W
Limiting Voltage U_L	1500 V	1500 V	500 V	500 V
Dielectric Strength (1) **Connections/Chassis**	2500 V, 1 min 10 mA max.	2500 V, 1 min 10 mA max.	2500 V, 1 min 10 mA max.	2500 V, 1 min 10 mA max.
Dielectric Strength (1) **Connections/Resistors**	-	-	2500 V, 1 min 10 mA max.	2500 V, 1 min 10 mA max.
Ohmic Value Range	0.046 Ω to 1 MΩ		0.092 Ω to 1 MΩ	
Tolerance	± 1 % to ± 10 %		± 1 % to ± 10 %	
Electrical Diagrams	  Shunt Version			

Note
(1) MIL STD 202 Method 301

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).

Tightening Torque on Heatsink	RTOP
	2 Nm

- For the electrical connections, it is recommended to use M4 x 6 screws and if necessary a washer of 1mm thickness. The recommended screw tightening torque is 1 Nm.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)}] + [R_{TH\ (c-a)}]}$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature.

$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component (see Table Special Features).

$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink depending on the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$: For RTOP 200 power rating 130 W at ambient temperature + 30 °C.

Thermal resistance (see table 1) $R_{TH\ (j-c)}$: 0.5 °C/W

$\Delta T \leq 125\ °C - 30\ °C - \leq 95\ °C$

$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{95}{130} = 0.73\ °C/W$$

$R_{TH\ (j-c)} \leq 0.5\ °C/W$

$R_{TH\ (c-a)} \leq 0.73\ °C/W - 0.5\ °C/W \leq 0.23\ °C/W$

OVERLOADS

The applied power is 2.5 x rated power for 5 s with a max. voltage of 2 x nominal voltage.

Accidental overload: The values indicated in the graph below are applicable to resistors in air or mounted onto a heatsink.

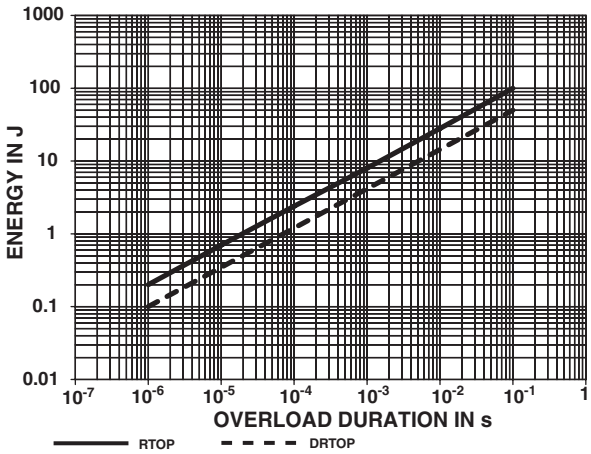
In case of multi-resistor devices, (DRTOP, TROP and QROP) the results apply to each resistor value in the device.

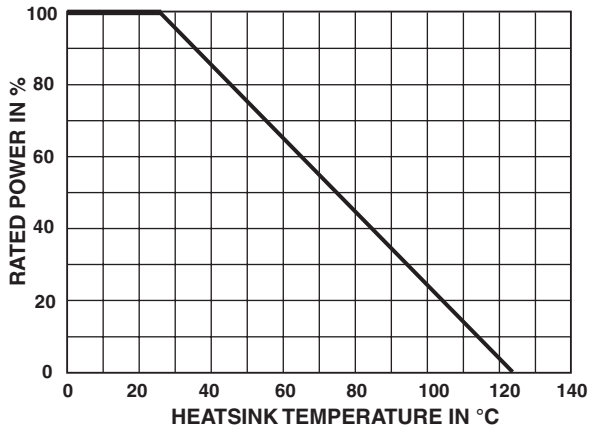
POWER RATING

The temperature of the heater should be maintained in the limit specified. To improve the thermal conductivity, surfaces in

contact should be laid on with a silicon grease and the torque applied on the screw for tightening should be around 2 Nm.

ENERGY CURVE





MARKING

Series, style, ohmic value (in), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Box of 10 units

ORDERING INFORMATION

RTOP	**200**	**5U**	**± 1 %**		**± %**		**V**			
DRTOP	**50**	**150U**	**5 %**	**15U**		**5 %**	**V**	**XXX**	**BO10**	**e**
				R1	T1	R2				
MODEL	STYLE	OHMIC VALUE	ABSOLUTE TOLERANCE PER RESISTOR				CONNECTIONS	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
RTOP DRTOP	100 50		Optional ± 1 % ± 2 % ± 5 % ± 10 %	To be precise for each resistor			V: Screw VS: RTOP Shunt	Optional		

GLOBAL PART NUMBER INFORMATION

R	T	O	P	1	0	0	V	5	R	0	0	K	B	

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOL.	PACKAGING	SPECIAL
RTOP	**100** **200**	**V** = Screw **VS** = RTOP Shunt	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R7** = 48.7 Ω **4871** = 4870 Ω **1002** = 10 000 Ω **R010** = 0.01 Ω **R680** = 0.68 Ω **2701** = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 10 pieces	As applicable Ex = **UA1**

Power Resistor for Mounting onto a Heatsink
Thick Film Technology

FEATURES

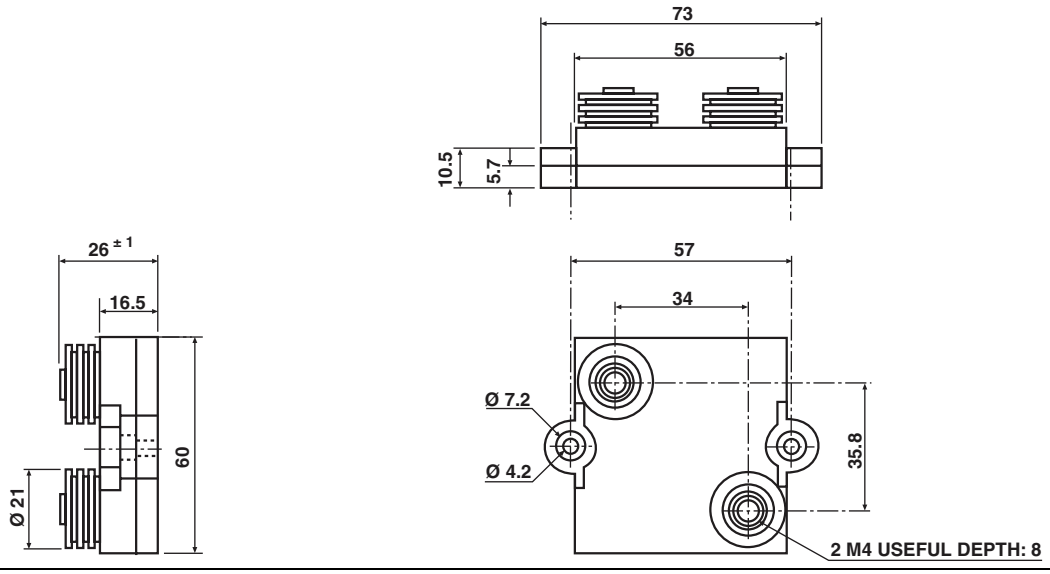
- High power rating: 250 W
- High overload capability up to 4 times nominal power (see energy curve)
- Easy mounting
- Low thermal radiation of the case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

Developed for specific applications such as railroad electrical traction, this series can bear short overloads as high as fifteen times the nominal power. Designed to be mounted onto a heatsink, these power resistors exhibit remarkable characteristics.

DIMENSIONS in millimeters

RPS 250D



Note
• Tolerance unless stated: ± 0.2 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina onto aluminum base
Resistive Element	Cermet
End Connections	Screws M4, (M5 on request)
Tightening Torque on Connections	2 Nm
Weight	170 g ± 10 %

ENVIRONMENTAL SPECIFICATIONS

Thermal Resistance	$R_{TH\ (j-c)}$ 0.22 °C/W
Temperature Range	- 55 °C + 125 °C
Climatic Category	55/125/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.24 Ω to 1 MΩ E24 series
Tolerance	± 1 % to ± 10 %
Power Rating chassis mounted **250 W** **1000 W**	 at 50 °C continuous at 25 °C for 10 s
Temperature Coefficient **Standard**	 ± 250 ppm/°C < 1 ± 150 ppm/°C > 1
Limiting Element Voltage U_L	5 kV_{RMS}
Dielectric Strength **MIL STD 202 (301), 1 min, 10 mA max.**	L connections 7 kV_{RMS} H connections 12 kV_{RMS}
Insulation Resistance	> 10^6 MΩ
Inductance	< 50 nH
Capacitance Resistor/ Ground	< 40 pF < 120 pF

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	NF EN 140000 CEI 115_1 4 P_r/10 s/U_L = 5000 V	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	NF EN 140000 CEI 68214 Test Na 5 cycles - 55 °C + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life	NF EN 140000 CEI 115_1 1000 h P_r at 70 °C	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	MIL STD 202 Method 103 B and D 56 days R.H. 95 %	< ± (0.5 % + 0.05 Ω)

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR		
Ohmic Value	< 1 Ω	> 1 Ω
Standard Tolerance	± 5 %	± 5 %
Standard TCR (- 55 °C to + 125 °C)	± 250 ppm/°C	± 150 ppm/°C
Tolerance On Request	± 1 %/± 2 %/± 10 %	

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of four screws (not supplied).

Tightening Torque on Heatsink	RPS 250
	3 Nm

- In order to improve the dissipation, either forced-air cooling or liquid cooling may be used.
- Do not forget to respect an insulation value between two resistors (dielectric strength in dry air 1 kV/mm).
- In any case the hot spot temperature, measured locally on the case must not exceed 125 °C.
- Test should be performed by the user.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)}]}$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (see Environmental Specifications).

$R_{TH\ (c\ -\ a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink, depending on the heatsink itself (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c\ -\ a)}$: for RPS 250 power dissipation 180 W at + 50 °C room temperature.

$\Delta T \leq 125\ °C - 50\ °C \leq 75\ °C$

$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)} = \frac{\Delta T}{P} = \frac{75}{180} = 0.42\ °C/W$

$R_{TH\ (j\ -\ c)} = 0.22\ °C/W$

$R_{TH\ (c\ -\ a)} \leq 0.42\ °C/W - 0.22\ °C/W \leq 0.20\ °C/W$

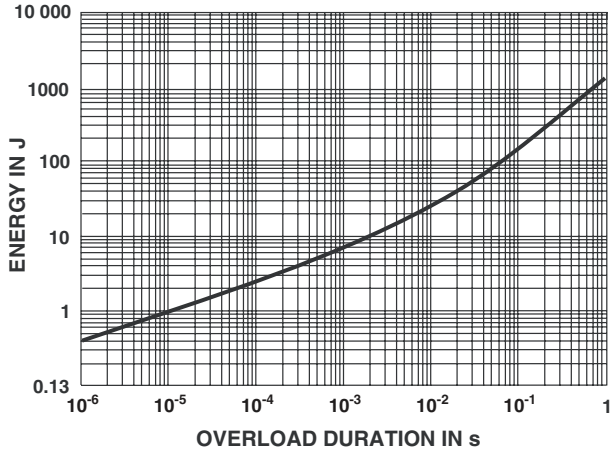
OVERLOADS

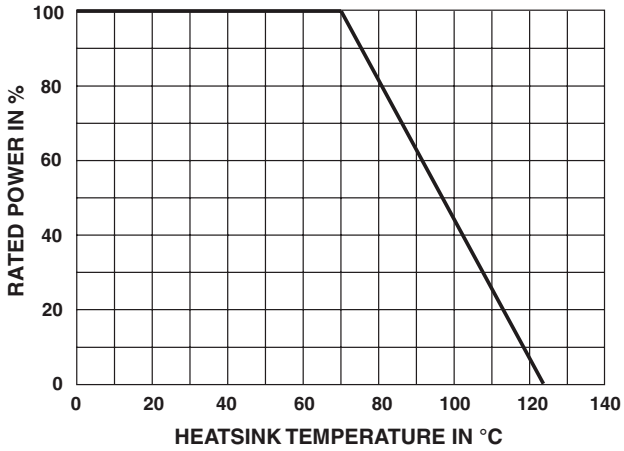
In any case the applied voltage must be lower than 2.5 U_n.
$U_{max.} < 2.5\ U_n < 12\ 500$ V.
Short time overload: 4 P_n/10 s
Accidental overload: The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

POWER RATING

The temperature of the heatsink should be maintained in the limit specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease.

ENERGY CURVE





MARKING

Series, style, ohmic value (in Ω), tolerance in %, manufacturing date, Vishay Sfernice trademark

PACKAGING

Box of 15 units

GLOBAL PART NUMBER INFORMATION

R	P	S	0	2	5	0	D	L	2	R	2	0	J	B	Z	A	3

GLOBAL MODEL	STYLE	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING	TYPE
RPS250	**D** = Diagonal connections **A** = Straight connections	**H** = Dielectric strength 12 kV **L** = Dielectric strength 7 kV	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2R20** = 2.20 Ω **48R7** = 48.7 Ω **47R0** = 47 Ω **1001** = 1 kΩ **4R70** = 4.7 Ω **R240** = 0.24 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box, 15 pcs **N** = Box, 15 pcs N/A (1 to 14 pcs by box)	Standard RPS250A = **Blank** Standard RPS250D = **ZA3** Special = **Blank** (for RPS250D) or as applicable = **ZAx**

Power Resistor for Mounting onto a Heatsink Thick Film Technology

FEATURES

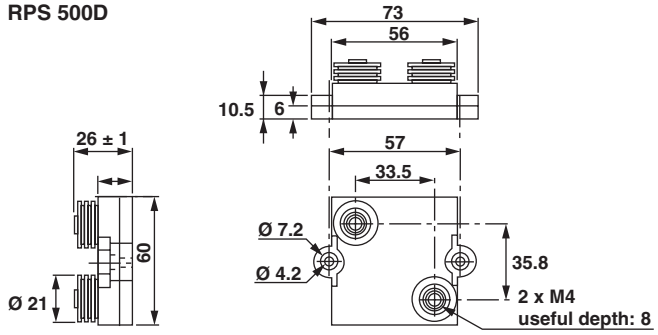
- High power rating: 500 W
- High overload capability up to 2 times rated Power (see energy curve)
- Heatsink mounting
- Low thermal radiation of the case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

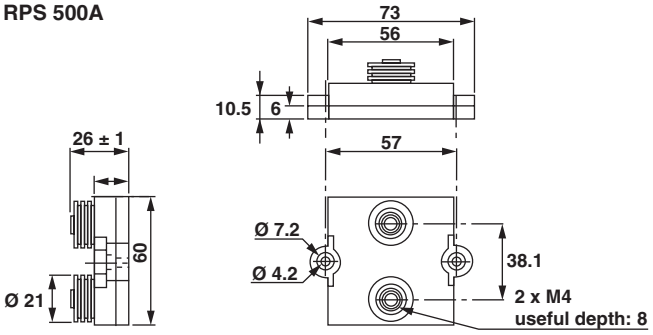
This range has been developed specifically for electrical traction applications and is capable of dissipating 500 W at + 70 °C. The remarkable performance characteristics are evident when used in severe pulse conditions. The copper base allows easy mounting on the heatsink and provides optimal dissipation conditions.

DIMENSIONS in millimeters

RPS 500D



RPS 500A



Note

• Tolerances unless stated: ± 0.2 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case
Substrate	Alumina onto base of nickel coated copper
Resistive Element	Cermet
End Connections	Screws M4 (M5 on request)
Tightening Torque on Connections	2 Nm
Tightening Torque on Heatsink	4 Nm
Weight	250 g ± 10 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

ELECTRICAL SPECIFICATIONS

Resistance Range	0.24 Ω to 1 MΩ E24 series
Tolerances	± 1 % to ± 10 %
Rated Power ($P_{r\,70}$) Chassis Mounted at 70 °C (Case Temperature)	500 W continuous load
Thermal Resistance of the Component	$R_{TH\,(j-c)}$: 0.11 °C/W
Temperature Coefficient	± 300 ppm/°C < 1 Ω ± 150 ppm/°C > 1 Ω
Limiting Element Voltage U_L	5 kV_{RMS}
Dielectric Strength	L: 7 kV_{RMS} - H: 12 kV_{RMS} MIL STD 202 Method 301: 1 min/10 mA max.
Insulation Resistance	> 10^6 MΩ under U_{ins} = 500 V_{DC} IEC 60115-1
Inductance	< 50 nH

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 2 P_r/10 s U_L = 5000 V	< ± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1/IEC60068-2-14 Test Na 5 cycles - 55 °C to + 125 °C	< ± (0.25 % + 0.05 Ω)
Load Life (Chassis Mounted)	IEC 60115-1 P_r (i.e. 500 W)/1000 h/70 °C (no cycling) (1)	< ± (0.5 % + 0.05 Ω)
Humidity (Steady State)	MIL STD 202 Method 103 B and D 56 days 95% RH/40 °C	< ± (0.5 % + 0.05 Ω)

Note

(1) Resistors are not tested and guaranteed in cycling conditions

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR		
Ohmic	< 1 Ω	> 1 Ω
Standard Tolerance	± 5 %	± 5 %
Standard TCR (- 55 °C to + 125 °C)	± 300 ppm/°C	± 150 ppm/°C
Tolerance on Request	± 1 %, ± 2 %, ± 10 %	

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of two screws tightened at 4 Nm for full power availability.

Tightening Torque on Heatsink	RPS 500
	4 Nm

- The following accessories are supplied with each product: 2 off CHC M4 x 16/16 class 8.8 for heatsink mounting,
  2 off TH M4 x 6/6 and 2 M4 contact lock washers for connections.

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 125 °C.
The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]}$$

P: Expressed in W

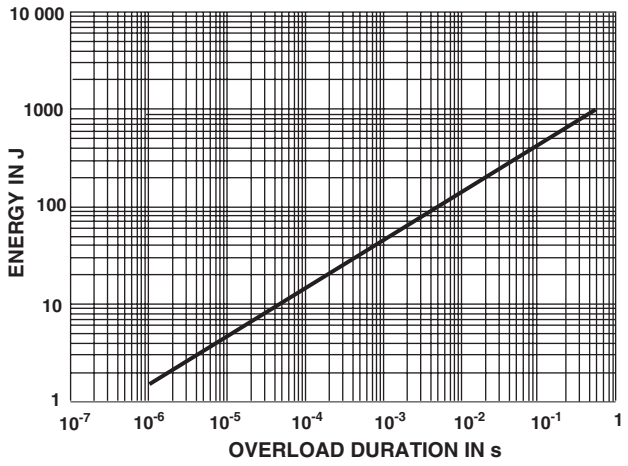
ΔT: Difference between maximum working temperature and room temperature.

$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: 0.11 °C/W.

$R_{TH\ (c\ -\ a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink, depending on the heatsink itself (type, shape) and the quality of the fastening device.

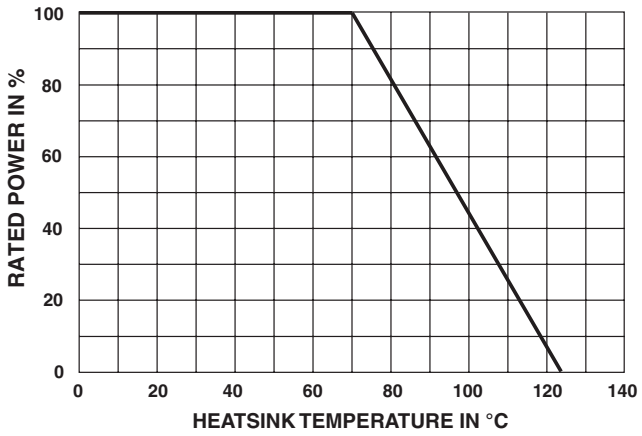
OVERLOADS

Short time overload: 2 P_n/10 s
Accidental overload: The values indicated in the graph below are applicable to resistors in air or mounted onto a heatsink.



POWER RATING

The heatsink temperature should be maintained at the values specified in fig. 2.
To optimise the thermal conduction, contacting surfaces should be coated with silicone grease and heatsink mounting screws tightened to 4 Nm.



MARKING

Series, style, ohmic value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Box of 15 units

ORDERING INFORMATION

RPS	500	DH	100 Ω	10 %	XXX	BO15	e
MODEL	STYLE	CONNECTIONS Optional H: Dielectric strength 12 kV L: Dielectric strength 7 kV	RESISTANCE VALUE	TOLERANCE ± 1 % ± 2 % ± 5 % ± 10 %	CUSTOM DESIGN Options on request TCR, shape, etc.	PACKAGING	LEAD (Pb)-FREE

SAP PART NUMBERING GUIDELINES

R	P	S	0	5	0	0	D	H	4	7	R	0	J	B	

GLOBAL MODEL	STYLE	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RPS500	**D** = Diagonal connections **A** = Straight connections	**H** = Dielectric strength 12 kV **L** = Dielectric strength 7 kV	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **47R0** = 47 Ω **1001** = 1 kΩ **4R70** = 4.7 Ω **R240** = 0.24 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 15 pieces **N** = Box 15 pieces N/A (1 to 14 pieces by Box)	As applicable ZAx.

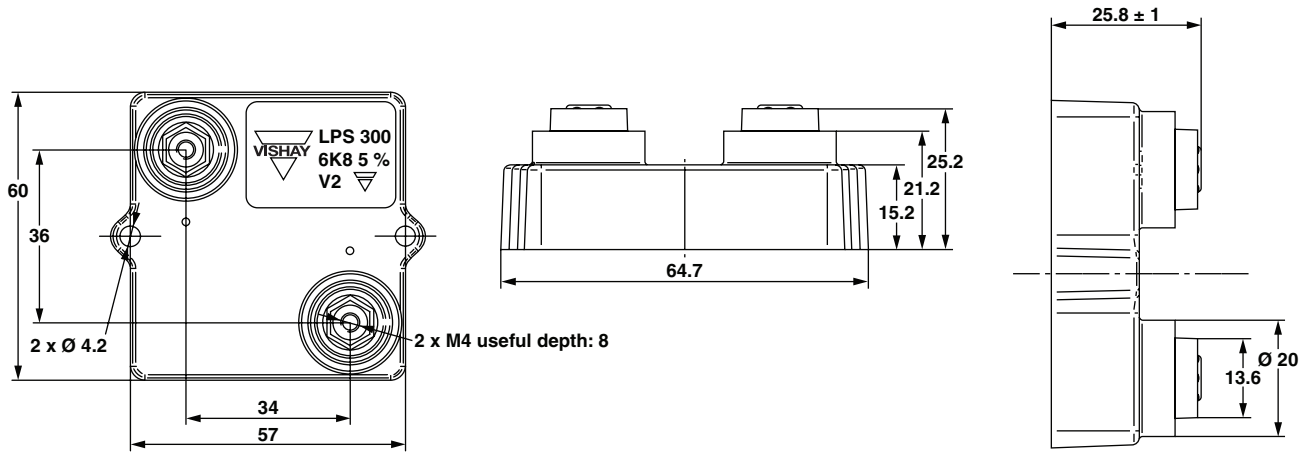
Power Resistor for Mounting onto a Heatsink Thick Film Technology

FEATURES

- 300 W at 85 °C case temperature
- Wide resistance range: 0.3 Ω to 900 kΩ E24 series
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Note
• Tolerances unless stated: ± 0.2 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case UL 94 V-0
Resistive Element	Thick film
Substrate	Alumina
End Connections	Screws M4
Tightening Torque	
- On Connections	2 Nm
- On Heatsink	2 Nm
Maximum Torque	2.5 Nm
Weight	83 g ± 10 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to 120 °C
Climatic Category	55/120/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.3 Ω to 900 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
Power Rating and Thermal Resistance	300 W at + 85 °C case temperature $R_{TH\ (j-c)}$: 0.112 °C/W
Temperature Coefficient - 55 °C/120 °C IEC 60115-1 Standard	$R \leq 1\ U$: ± 500 ppm/°C $1\ U < R \leq 10\ U$: ± 300 ppm/°C $10\ U < R$: ± 150 ppm/°C
Limiting Element Voltage U_L	5 kV
Dielectric Strength IEC 60115-1, 1 min, 10 mA max.	7 kV_{RMS} or 12 kV_{RMS}
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	83.33 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 4 x P_r/10 s $U_{max.} \leq U_L$ = 5000 V	± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1/IEC 60068-2-14 Test Na 5 cycles - 55 °C to + 120 °C	± (0.5 % + 0.05 Ω)
Load Life	IEC 60115-1 1000 h (90/30) P_r at 85 °C	± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1 56 days RH 95 %/40 °C	± (0.5 % + 0.05 Ω)
Vibration	MIL STD 202 Method 204 Cond. D (10 *g*; 5/500 Hz)	± (0.25 % + 0.05 Ω)
Climatic Sequence	IEC 60115-1 (55/120/56)	± (1 % + 0.05 Ω)

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning) or a thermal film (type Q Pad II) easier and faster to install than the grease.
- The fastening of the resistor to the heatsink is under pressure control of two screws tightened at 2 Nm for full power availability.

Tightening Torque on Heatsink	LPS 300
	2 Nm

- The following accessories are supplied with each product: 2 screws CHC M4 x 25 class 8.8 and 2 M4 contact lock washers for heatsink mounting,
  2 screws TH M4 x 6/6 and 2 M4 contact lock washers for connections. 2 off CHC M4 x 16/16 class 8.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 120 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)}]}$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (see specifications environmental paragraph).

$R_{TH\ (c\ -\ a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the thermal interface, the heatsink (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c\ -\ a)}$ for LPS 300 power dissipation 180 W at + 50 °C room temperature.

$\Delta T \leq 120\ °C - 50\ °C = 70\ °C$

$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)} = \frac{\Delta T}{P} = \frac{70}{180} = 0.388\ °C/W$

$R_{TH\ (j\ -\ c)} = 0.112\ °C/W$

$R_{TH\ (c\ -\ a)} = 0.388\ °C/W - 0.112\ °C/W = 0.276\ °C/W$

Power Resistor for Mounting onto a Heatsink
Thick Film Technology

OVERLOADS

In any case the applied voltage must be lower than U_L = 5000 V.

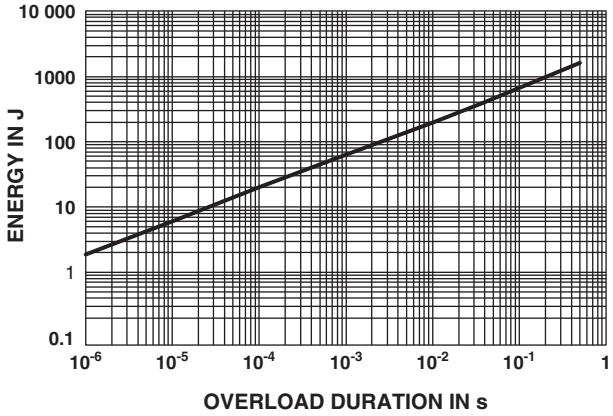
Short time overload: 4 x P_n/10 s

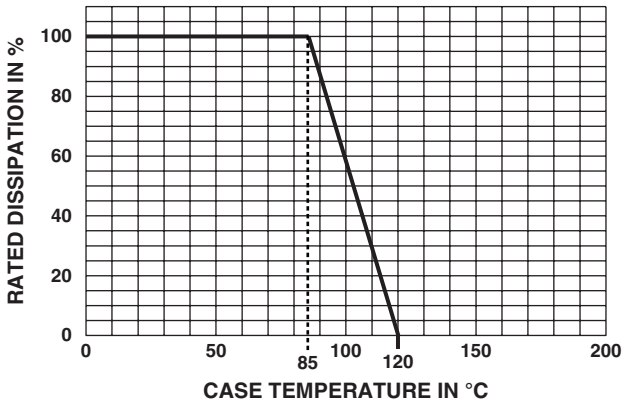
Accidental overload: The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.

POWER RATING

The temperature of the case should be maintained within the limits specified in the following figure.
To optimize the thermal conduction, contacting surfaces should be coated with silicone grease or thermal film, and heatsink mounting screws tightened to 2 Nm.

ENERGY CURVE





MARKING

Series, style, ohmic value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Box of 15 units

ORDERING INFORMATION

LPS	300	100 kΩ	± 1 %	xxx	BO15	e
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE ± 1 % ± 2 % ± 5 % ± 10 %	CUSTOM DESIGN Optional on request: Special TCR, shape etc.	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

L	P	S	0	3	0	0	H	4	7	R	0	J	B	

GLOBAL MODEL	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
LPS 300	**L** = Dielectric strength 7 kV **H** = Dielectric strength 12 kV	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R7** = 48.7 Ω **47R0** = 47 Ω **1001** = 1 kΩ **4R70** = 4.7 Ω **R240** = 0.24 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 15 pieces **N** = Box 15 pieces N/A (1 to 14 pieces by box)	As applicable ZAx

LPS 600

Vishay Sfernice

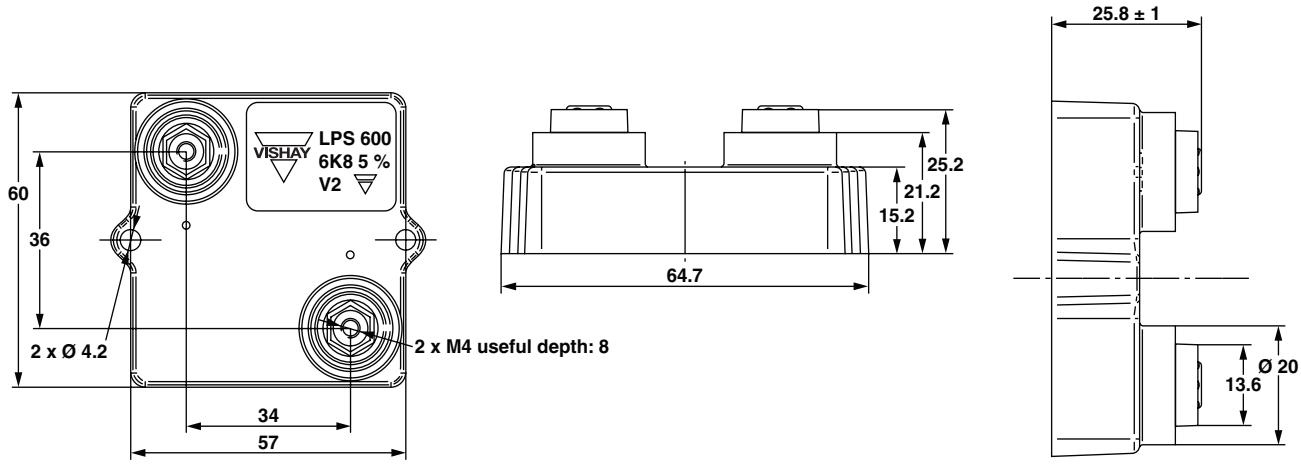
Power Resistor for Mounting onto a Heatsink Thick Film Technology

FEATURES

- 600 W at 85 °C case temperature
- Wide resistance range: 0.3 Ω to 900 kΩ E24 series
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Note

• Tolerances unless stated: ± 0.2 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case UL 94 V-0
Resistive Element	Thick film
Substrate	Alumina
End Connections	Screws M4
Tightening Torque	
- On Connections	2 Nm
- On Heatsink	2 Nm
Maximum Torque	2.5 Nm
Weight	83 g ± 10 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to 155 °C
Climatic Category	55/155/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.3 Ω to 900 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
Power Rating and Thermal Resistance	600 W at + 85 °C case temperature $R_{TH\ (j-c)}$: 0.112 °C/W
Temperature Coefficient - 55 °C/155 °C IEC 60115-1 Standard	$R \leq 1\ U$: ± 500 ppm/°C $1\ U < R \leq 10\ U$: ± 300 ppm/°C $10\ U < R$: ± 150 ppm/°C
Limiting Element Voltage U_L	5 kV
Dielectric Strength IEC 60115-1, 1 min, 10 mA max.	7 kV_{RMS} or 12 kV_{RMS}
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	41.66 kΩ

For technical questions, contact: sfer@vishay.com

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 2 x P_r/10 s $U_{max.} \leq U_L$ = 5000 V	± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1/IEC 60068-2-14 Test Na 50 cycles - 55 °C to + 155 °C	± (0.5 % + 0.05 Ω)
Load Life	IEC 60115-1 1000 h (90/30) P_r at 85 °C	± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1 56 days RH 95 %/40 °C	± (0.5 % + 0.05 Ω)
Vibration	MIL STD 202 Method 204 Cond. D (10 *g*; 5/500 Hz)	± (0.25 % + 0.05 Ω)
Climatic Sequence	IEC 60115-1 (55/155/56)	± (1 % + 0.05 Ω)

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning) or a thermal film (type Q Pad II) easier and faster to install than the grease.
- The fastening of the resistor to the heatsink is under pressure control of two screws tightened at 2 Nm for full power availability.

Tightening Torque on Heatsink	LPS 300
	2 Nm

- The following accessories are supplied with each product: 2 screws CHC M4 x 25 class 8.8 and 2 M4 contact lock washers for heatsink mounting,
  2 screws TH M4 x 6/6 and 2 M4 contact lock washers for connections.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 155 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]}$$

P: Expressed in W
ΔT: Difference between maximum working temperature and room temperature
$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (see specifications environmental paragraph).
$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the thermal interface, the heatsink (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$ for LPS 600 power dissipation 180 W at + 50 °C room temperature.
$\Delta T \leq 155\ °C - 50\ °C = 105\ °C$
$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{105}{180} = 0.58\ °C/W$
$R_{TH\ (j-c)} = 0.112\ °C/W$
$R_{TH\ (c-a)} = 0.58\ °C/W - 0.112\ °C/W = 0.468\ °C/W$

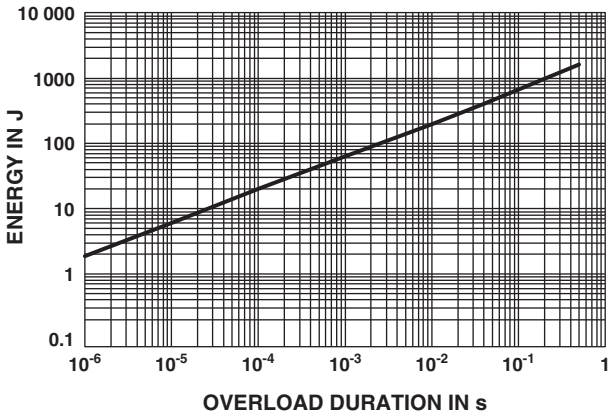
OVERLOADS

In any case the applied voltage must be lower than U_L = 5000 V.

Short time overload: 2 x P_r/10 s

Accidental overload: The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.

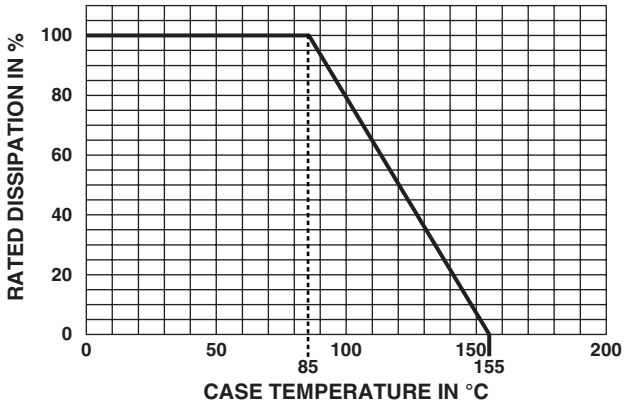
ENERGY CURVE



POWER RATING

The temperature of the case should be maintained within the limits specified in the following figure.

To optimize the thermal conduction, contacting surfaces should be coated with silicone grease or thermal film, and heatsink mounting screws tightened to 2 Nm.



MARKING

Series, style, ohmic value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Box of 15 units

ORDERING INFORMATION

LPS	600	100 kΩ	± 1 %	xxx	BO15	e
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE ± 1 % ± 2 % ± 5 % ± 10 %	CUSTOM DESIGN Optional on request: Special TCR, shape etc.	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

L	P	S	0	6	0	0	H	4	7	R	0	J	B	

GLOBAL MODEL	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
LPS 600	**L** = Dielectric strength 7 kV **H** = Dielectric strength 12 kV	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R7** = 48.7 Ω **47R0** = 47 Ω **1001** = 1 kΩ **4R70** = 4.7 Ω **R240** = 0.24 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 15 pieces **N** = Box 15 pieces N/A (1 to 14 pieces by box)	As applicable ZAx

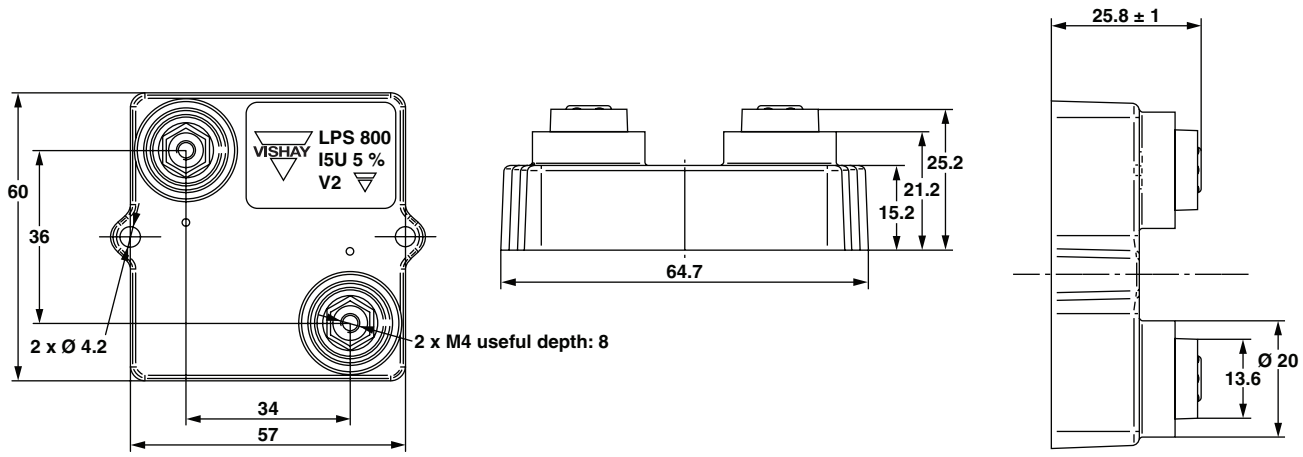
Power Resistor for Mounting onto a Heatsink
Thick Film Technology

FEATURES

- 800 W at 85 °C case temperature
- Wide resistance range: 0.3 Ω to 900 kΩ E24 series
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Note
• Tolerances unless stated: ± 0.2 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Insulated case UL 94 V-0
Resistive Element	Thick film
Substrate	Alumina
End Connections	Screws M4
Tightening Torque	
- On Connections	2 Nm
- On Heatsink	2 Nm
Maximum Torque	2.5 Nm
Weight	83 g ± 10 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to 175 °C
Climatic Category	55/175/56

ELECTRICAL SPECIFICATIONS

Resistance Range	0.3 Ω to 900 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
Power Rating and Thermal Resistance	800 W at + 85 °C case temperature $R_{TH\ (j-c)}$: 0.112 °C/W
Temperature Coefficient - 55 °C/175 °C IEC 60115-1 Standard	$R \leq 1\ U$: ± 500 ppm/°C $1\ U < R \leq 10\ U$: ± 300 ppm/°C $10\ U < R$: ± 150 ppm/°C
Limiting Element Voltage U_L	5 kV
Dielectric Strength IEC 60115-1, 1 min, 10 mA max.	7 kV_{RMS} or 12 kV_{RMS}
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	31.25 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 1.5 x P_r/10 s $U_{max.} \leq U_L$ = 5000 V	± (0.25 % + 0.05 Ω)
Rapid Temperature Change	IEC 60115-1/IEC 60068-2-14 Test Na 50 cycles - 55 °C to + 175 °C	± (0.5 % + 0.05 Ω)
Load Life	IEC 60115-1 1000 h (90/30) P_r at 85 °C	± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1 56 days RH 95 %/40 °C	± (0.5 % + 0.05 Ω)
Vibration	MIL STD 202 Method 204 Cond. D (10 *g*; 5/500 Hz)	± (0.25 % + 0.05 Ω)
Climatic Sequence	IEC 60115-1 (55/175/56)	± (1 % + 0.05 Ω)

RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning) or a thermal film (type Q Pad II) easier and faster to install than the grease.
- The fastening of the resistor to the heatsink is under pressure control of two screws tightened at 2 Nm for full power availability.

Tightening Torque on Heatsink	LPS 800
	2 Nm

- The following accessories are supplied with each product: 2 screws CHC M4 * 25 class 8.8 and 2 M4 contact lock washers for heatsink mounting,
  2 screws TH M4 * 6/6 and 2 M4 contact lock washers for connections.

CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 175 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]}$$

P: Expressed in W
ΔT: Difference between maximum working temperature and room temperature
$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (see specifications environmental paragraph).
$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the thermal interface, the heatsink (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c-a)}$ for LPS 800 power dissipation 180 W at + 50 °C room temperature.
$\Delta T \leq 175\ °C - 50\ °C = 125\ °C$
$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{125}{180} = 0.69\ °C/W$
$R_{TH\ (j-c)} = 0.112\ °C/W$
$R_{TH\ (c-a)} = 0.69\ °C/W - 0.112\ °C/W = 0.578\ °C/W$

Power Resistor for Mounting onto a Heatsink
Thick Film Technology

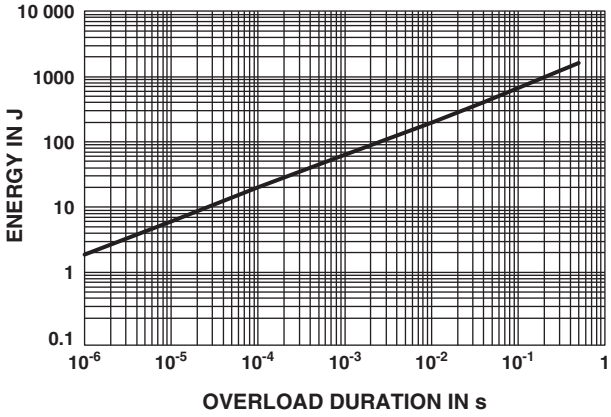
OVERLOADS

In any case the applied voltage must be lower than U_L = 5000 V.

Short time overload: 1.5 x P_r/10 s

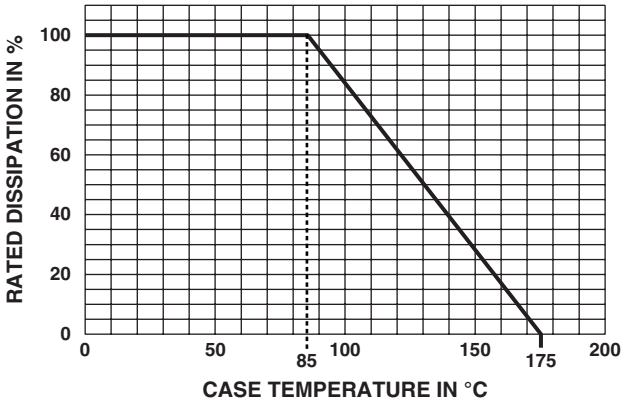
Accidental overload: The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING

The temperature of the case should be maintained within the limits specified in the following figure.
To optimize the thermal conduction, contacting surfaces should be coated with silicone grease or thermal film, and heatsink mounting screws tightened to 2 Nm.



MARKING

Series, style, ohmic value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Box of 15 units

ORDERING INFORMATION

LPS	800	100 kΩ	± 1 %	xxx	BO15	e
MODEL	STYLE	RESISTANCE VALUE	TOLERANCE ± 1 % ± 2 % ± 5 % ± 10 %	CUSTOM DESIGN Optional on request: Special TCR, shape etc.	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

L	P	S	0	8	0	0	H	4	7	R	0	J	B	

GLOBAL MODEL	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
LPS 800	**L** = Dielectric strength 7 kV **H** = Dielectric strength 12 kV	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R7** = 48.7 Ω **47R0** = 47 Ω **1001** = 1 kΩ **4R70** = 4.7 Ω **R240** = 0.24 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**B** = Box 15 pieces **N** = Box 15 pieces N/A (1 to 14 pieces by box)	As applicable ZAx

Mounting Instructions and Thermal Considerations

1. HEATSINK SPECIFICATION

The mounting area on the heatsink and the bottom of the LPS must be free of particles. Surfaces in contact must be carefully cleaned in order to obtain the maximum thermal conductivity between the component and the heatsink.
The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm. Roughness of the heatsink must be around 6.3 µm.

2. CHOICE OF THE THERMAL INTERFACE

In order to improve thermal conductivity, surfaces in contact should be coated with a silicone grease or a thermal film. The function of this element is to minimise the thermal interface resistance by filling the potential air voids. Since the thermal resistance of air is very high, these voids will substantially degrade performance. Therefore, it is important to use a thermal interface material to fill these air voids. Several materials are available to reduce thermal resistance between the resistor and heatsink surface.

Thermal grease is an addition of thermally conductive particles with a fluid typically, a silicone oil. The final consistency is like a grease.

We recommend to use for the thermal grease:

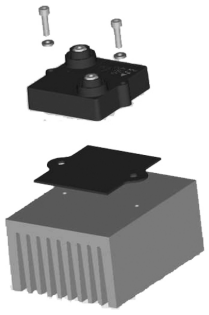
- SI 340 from BlueStar Silicones (thermal conductivity at 25 °C = 0.41 W/mK - dielectric strenght = 15 kV/mm) or
- Dow 340 from Dow Corning (thermal conductivity = 0.59 W/mK - dielectric strength = 8.3 kV/mm).

Thermal interface can be applied either to the base area of the component or the area of the heatsink.

Thermal film, an alternative to thermal grease, is easier and faster to install than the grease. Moreover, you can use different times the same thermal films and this element allows to have uniform thickness. These thermally conductive pads are available in sheet form or in pre-cut shapes. These pads utilize silicone rubber binder combined with a variety of materials such as aluminum oxide, boron nitride or magnesium oxide to provide good thermal conductivity. For the thermal interface, we recommend to use Q-PAD II from Berquist (thermal conductivity = 2.5 W/mK; non-insulated). Q-Pad II is available with special dimensions for the LPS (Vishay description: 52338833 Rev B; P/N Berquist: BG422257; thickness: 0.152 mm). The Q-Pad II film is not electrically insulated. Electrically insulated version: Poly-Pad K10 from Berquist (R_{TH} = 1.3 W/mK).

3. MOUNTING THE RESISTOR

Avoid any movement of the resistor once positioned on the heatsink. The fixing screws are inserted and evenly tightened by hand (around 0.5 Nm) or by electric or pneumatic screwdrivers with a torque of 0.5 Nm. After, the screws are tightened again to the final torque. The use of torque wrenches with automatic release is recommended. The two step procedure must be strictly followed to allow the component base-plate to relax and conform to the heatsink. The bus-bars must be mounted onto the connections of the power resistor with the recommended torque. The cross sections of the bus-bars must be sufficiently large to avoid heating of the module by bus-bar resistive losses. Stress to the power resistor from bus-bar forces must be minimized during assembly, transportation and operation.



Mounting assembly for LPS

MOUNTING INFORMATION		
MOUNTING	**SCREW**	**TORQUE VALUES RECOMMENDED (Nm)**
Resistor on heatsink	M4	2
Connexions	M4	2

Note

- Maximum torque: 2.5 mm

APPLICATION NOTE

Mounting Instructions and Thermal Considerations

4. THERMAL CONSIDERATIONS

For reliable operation it is crucial not to exceed the maximum specified temperature for the resistive element

THERMAL INFORMATION ON LPS RESISTORS		
	MAXIMAL TEMPERATURE FOR RESISTIVE ELEMENT	THERMAL RESISTIVITY BETWEEN RESISTIVE ELEMENT AND CASE $R_{TH\ (j\ -\ c)}$
LPS300	120 °C	0.112 °C/W
LPS600	155 °C	0.112 °C/W
LPS800	175 °C	0.112 °C/W

Excessive resistive temperatures will cause a drift of the resistance value or reduced component life. Proper thermal design followed by temperature measurements to verify the design, and consistent mounting procedures will avoid these problems. The film temperature (T_j) is related to the case temperature (T_C) by the parameter "Thermal resistance" $R_{TH\ (j\ -\ c)}$. Thermal resistance is expressed in °C/W. In other words, the thermal resistance $R_{TH\ (j\ -\ c)}$ is the temperature rise (°C) between the film and the case per W applied.

5. CHOICE OF THE HEATSINK

The user must choose the heatsink according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 120 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)}]}$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature

$R_{TH\ (j\ -\ c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: (See specifications environmental paragraph).

$R_{TH\ (c\ -\ a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the thermal interface, the heatsink (type, shape) and the quality of the fastening device.

Example:

$R_{TH\ (c\ -\ a)}$ for LPS 300 power dissipation 180 W at + 50 °C room temperature.

$\Delta T \leq 120\ °C - 50\ °C = 70\ °C$

$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ a)} = \frac{\Delta T}{P} = \frac{70}{180} = 0.388\ °C/W$

$R_{TH\ (j\ -\ c)} = 0.112\ °C/W$

$R_{TH\ (c\ -\ a)} = 0.388\ °C/W - 0.112\ °C/W = 0.276\ °C/W$

6. MECHANICAL PROPERTIES

PARAMETER		VALUE	UNIT
Dimensions		65.2 x 60 x 25.8	mm
Clearance distance in air	Termination to base	14.7 min.	mm
	Termination to term	40 min.	mm
Surface creepage distance	Termination to base	30 min.	mm
	Termination to term	83 min.	mm

The clearance distance in air is defined as the shortest direct path between the terminals and the base and between terminals.

The surface creepage distance is the shortest path along the plastic housing between the terminals and the base and between the terminals.

Mounting Instructions and Thermal Considerations

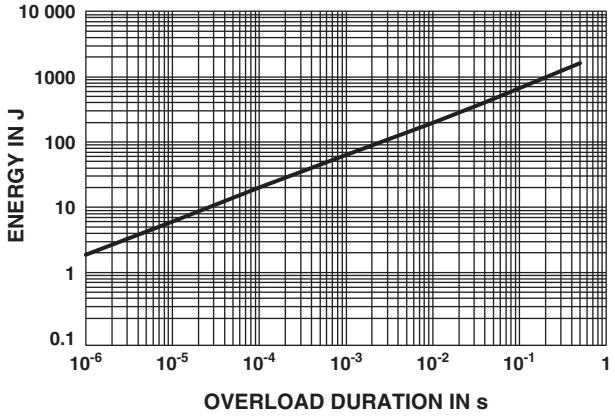
7. OVERLOAD

In any case the applied voltage must be lower than U_L = 5000 V.

Short time overload: LPS300: 4 x P_r/10 s, LPS600: 2 x P_r/10 s, LPS800: 1.5 x P_r/10 s

Accidental overload: The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



Single pulse:

These informations are for a single pulse on a cold resistor at 25 °C (not already used for a dissipation) and for pulses of 100 ms maximum duration.

The formula used to calculate *E* is:

$$E = P \times t = \frac{U^2}{R} \times t$$

with:

E (J): Pulse energy
P (W): Pulse power
t (s): Pulse duration
U (V): Pulse voltage
R (W): Resistor

The energy calculated must be less than that allowed by the graph.

Repetitive or Superimposed Pulses:

The following formula is used to calculate the “equivalent“ energy of a repetitive pulse or the “equivalent energy“ of a pulse on a resistor that is already dissipating power.

The formula used to calculate *E* is:

$$E = P \times t = \frac{U^2}{R} \times t$$

with:

E_c (J): Equivalent pulse energy
E (J): Known pulse energy
P_r: Resistor power rating
P_a: Mean power being dissipated

The energy calculated must be less than that allowed by the graph and the average power dissipated (P_a) must not exceed the continuous power of resistor.

30 W Power Resistor Thick Film Technology

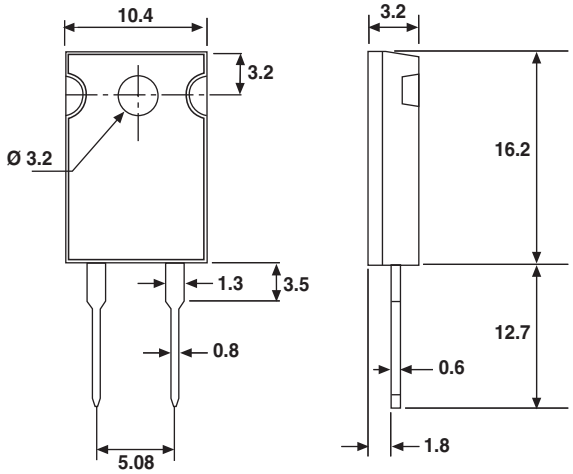
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

FEATURE

- 30 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.010 Ω to 550 kΩ
- Non inductive
- TO-220 package: Compact and easy to mount
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



Note
• Tolerances unless stated: ± 0.3 mm

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2 g max.
Mounting Torque	1 Nm

DIMENSIONS

Standard Package	TO-220 isolated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/155/56
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

ELECTRICAL SPECIFICATIONS

Resistance Range	0.010 Ω to 550 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
Dissipation and Associated	Onto a heatsink
Power Rating and Thermal Resistance of the Component	30 W at + 25 °C (case temp.) $R_{TH\ (j\ -\ c)}$: 4.2 °C/W Free air: 2.25 W at + 25 °C
Temperature Coefficient **Standard**	See Performance table ± 150 ppm/°C
Limiting Element Voltage U_L	250 V
Dielectric Strength MIL STD 202	1500 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	2.08 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 1.5 P_r/5 s U_S < 1.5 U_L	± (0.5 % + 0.005 Ω)
Rapid Temperature Change	EN 60115-1 IEC 60068-2-14 Test Na 5 cycles - 55 °C to + 155 °C	± (0.5 % + 0.005 Ω)
Load Life	EN 60115-1 1000 h P_r at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	MIL-STD-202 Method 103 B Cond. D	± (0.5 % + 0.005 Ω)
Vibration	MIL-STD-202 Method 204 Cond. D	± (0.2 % + 0.005 Ω)
Terminal Strength	MIL-STD-202 Method 211 Cond. A1	± (0.2 % + 0.005 Ω)
Shock	100G, MIL-STD-202 Method 213 Cond. I	± (0.5 % + 0.005 Ω)

SPECIAL FEATURES				
Resistance Values	≥ 0.010	≥ 0.015	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Typical Temperature Coefficient (- 55 ° to + 155 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 150 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W
ΔT: Difference between maximum working temperature and room temperature
$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component.
$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device, and the thermal resistance of the thermal compound.

Example:

$R_{TH\ (c-a)}$ for LTO 30 power rating 10 W at ambient temperature + 25 °C

Thermal resistance $R_{TH\ (j-c)}$: 4.2 °C/W

Considering equation (1) we have:

$$\Delta T = 150\ °C - 25\ °C = 125\ °C$$

$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{125}{10} = 12.5\ °C/W$$

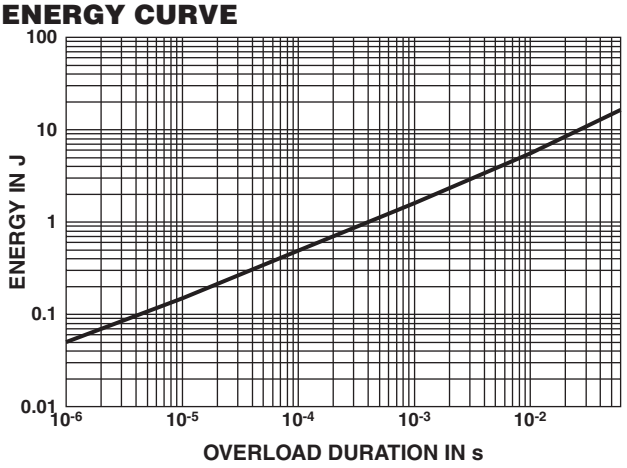
$$R_{TH\ (c-a)} = 12.5\ °C/W - 4.2\ °C/W = 8.3\ °C/W$$

with a thermal grease $R_{TH\ (c-h)}$ = 1 °C/W, we need a heatsink with $R_{TH\ (h-a)}$ = 7.3 °C/W.

OVERLOADS

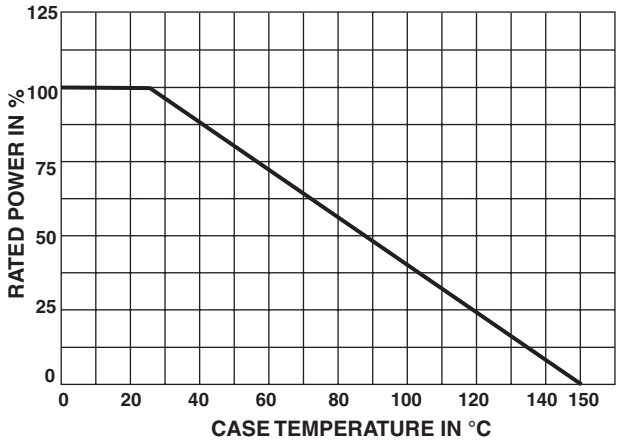
In any case the applied voltage must be lower than the maximum overload voltage of 375 V.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING

The temperature of the case should be maintained within the limits specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Tube of 50 units

ORDERING INFORMATION

LTO	30	F	2.7 kΩ	± 1 %	xxx	TU50	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: Special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

L	T	O	0	3	0	F	2	7	0	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
LTO	**030**	**F** = Radial leads	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R4700** = 0.47 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Tube 50 pieces	**E3** = Pure tin

Power Resistor Thick Film Technology

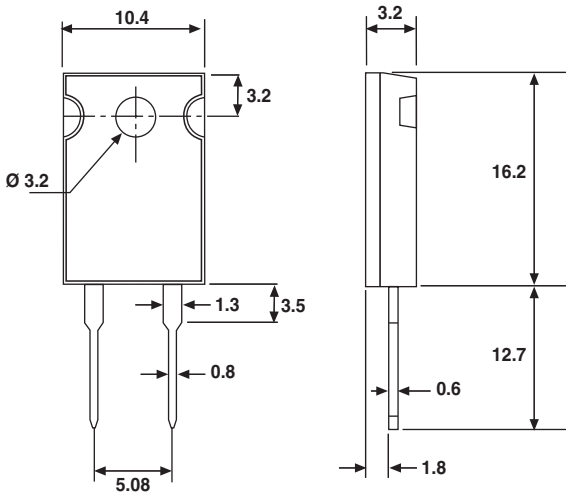
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

FEATURE

- 50 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.010 Ω to 550 kΩ
- Non inductive
- TO-220 package: Compact and easy to mount
- Isolated case
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2 g max.
Mounting Torqure	1 Nm

DIMENSIONS

Standard Package	TO-220 isolated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/155/56
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

ELECTRICAL SPECIFICATIONS

Resistance Range	0.010 Ω to 550 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
Dissipation and Associated	Onto a heatsink
Power Rating and Thermal Resistance of the Component	50 W at + 25 °C (case temp.) $R_{TH\ (j-c)}$: 2.5 °C/W Free air: 2.5 W at + 25 °C
Temperature Coefficient **Standard**	See Performance table ± 150 ppm/°C
Limiting Element Voltage U_L	250 V
Dielectric Strength MIL-STD-202	1500 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	1.25 kΩ

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 1.5 P_r/5 s $U_S < 1.5\ U_L$	± (0.5 % + 0.005 Ω)
Rapid Temperature Change	EN 60115-1 IEC 60068-2-14 Test Na 5 cycles - 55 °C to + 155 °C	± (0.5 % + 0.005 Ω)
Load Life	EN 60115-1 1000 h P_r at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	MIL-STD-202 Method 103 B Cond. D	± (0.5 % + 0.005 Ω)
Vibration	MIL-STD-202 Method 204 Cond. D	± (0.2 % + 0.005 Ω)
Terminal Strength	MIL-STD-202 Method 211 Cond. A1	± (0.2 % + 0.005 Ω)
Shock	100G, MIL-STD-202 Method 213 Cond. I	± (0.5 % + 0.005 Ω)

SPECIAL FEATURES				
Resistance Values	≥ 0.010	≥ 0.015	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Typical Temperature Coefficient (- 55 ° to + 155 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 150 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W
ΔT: Difference between maximum working temperature and room temperature
$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component.
$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device, and the thermal resistance of the thermal compound.

Example:

$R_{TH\ (c-a)}$ for LTO 50 power rating 10 W at ambient temperature + 25 °C

Thermal resistance $R_{TH\ (j-c)}$: 2.5 °C/W

Considering equation (1) we have:

$$\Delta T = 150\ °C - 25\ °C = 125\ °C$$

$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{125}{10} = 12.5\ °C/W$$

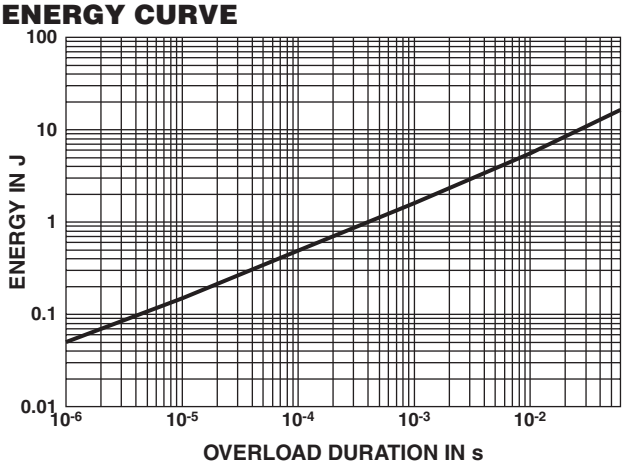
$$R_{TH\ (c-a)} = 12.5\ °C/W - 2.5\ °C/W = 10\ °C/W$$

with a thermal grease $R_{TH\ (c-h)}$ = 1 °C/W, we need a heatsink with $R_{TH\ (h-a)}$ = 9 °C/W.

OVERLOADS

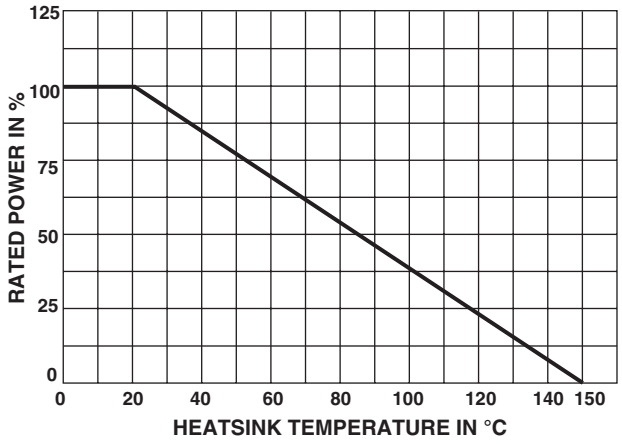
In any case the applied voltage must be lower than the maximum overload voltage of 375 V.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING

The temperature of the case should be maintained within the limits specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Tube of 50 units

ORDERING INFORMATION

LTO	50	F	2.7 kΩ	± 1 %	xxx	TU50	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: Special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

L	T	O	0	5	0	F	2	7	0	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
LTO	**050**	**F** = Radial leads	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R4700** = 0.47 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Tube 50 pieces	**E3** = Pure tin

LTO 100

Vishay Sfernice

Power Resistor Thick Film Technology

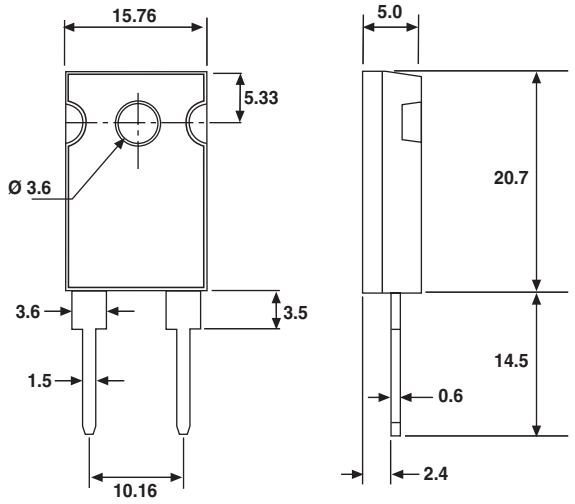
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

FEATURE

RoHS COMPLIANT

- 100 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.015 Ω to 1 MΩ
- Non inductive
- TO-247 package: Compact and easy to mount
- Compliant to RoHS directive 2002/95/EC

DIMENSIONS in millimeters



MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	3.5 g max.
Mounting Torque	1 Nm

DIMENSIONS

Standard Package	TO-247 isolated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 175 °C
Climatic Category	55/175/56
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

ELECTRICAL SPECIFICATIONS

Resistance Range	0.015 Ω to 1 MΩ
Tolerances (Standard)	± 1 % to ± 10 %
Dissipation and Associated	Onto a heatsink
Power Rating and Thermal Resistance of the Component	100 W at + 25 °C (case temp.) $R_{TH\ (j-c)}$: 1.5 °C/W Free air: 3.5 W at + 25 °C
Temperature Coefficient **Standard**	See Performance table ± 150 ppm/°C
Limiting Element Voltage U_L	375 V
Dielectric Strength MIL STD 202	1500 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	1.41 kΩ

For technical questions, contact: sfer@vishay.com

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 1.5 P_r/5 s U_S < 1.5 U_L	± (0.5 % + 0.005 Ω)
Rapid Temperature Change	EN 60115-1 IEC 60068-2-14 Test Na 5 cycles - 55 °C to + 175 °C	± (0.5 % + 0.005 Ω)
Load Life	EN 60115-1 1000 h P_r at + 25 °C	± (1 % + 0.005 Ω)
Humidity (Steady State)	MIL STD 202 Method 103 B Cond. D	± (0.5 % + 0.005 Ω)
Vibration	MIL STD 202 Method 204 Cond. D	± (0.2 % + 0.005 Ω)
Terminal Strength	MIL STD 202 Method 211 Cond. A1	± (0.2 % + 0.005 Ω)
Shock	100G, MIL STD 202 Method 213 Cond. I	± (0.5 % + 0.005 Ω)

SPECIAL FEATURES				
Resistance Values	≥ 0.010	≥ 0.015	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Typical Temperature Coefficient (- 55 ° to + 175 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

CHOICE OF THE HEATSINK

The user must choose according to the working conditions of the component (power, room temperature).
Maximum working temperature must not exceed 175 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH\ (j-c)} + R_{TH\ (c-a)}]} \quad (1)$$

P: Expressed in W
ΔT: Difference between maximum working temperature and room temperature
$R_{TH\ (j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component.
$R_{TH\ (c-a)}$: Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device, and the thermal resistance of the thermal compound.

Example:

$R_{TH\ (c-a)}$ for LTO 100 power rating 10 W at ambient temperature + 25 °C

Thermal resistance $R_{TH\ (j-c)}$: 1.5 °C/W

Considering equation (1) we have:

$$\Delta T = 175\ °C - 25\ °C = 150\ °C$$

$$R_{TH\ (j-c)} + R_{TH\ (c-a)} = \frac{\Delta T}{P} = \frac{150}{10} = 15\ °C/W$$

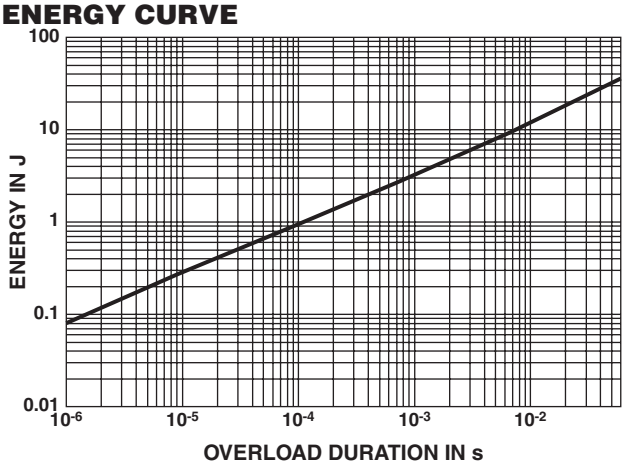
$$R_{TH\ (c-a)} = 15\ °C/W - 1.5\ °C/W = 13.5\ °C/W$$

with a thermal grease $R_{TH\ (c-h)}$ = 1 °C/W, we need a heatsink with $R_{TH\ (h-a)}$ = 12.5 °C/W.

OVERLOADS

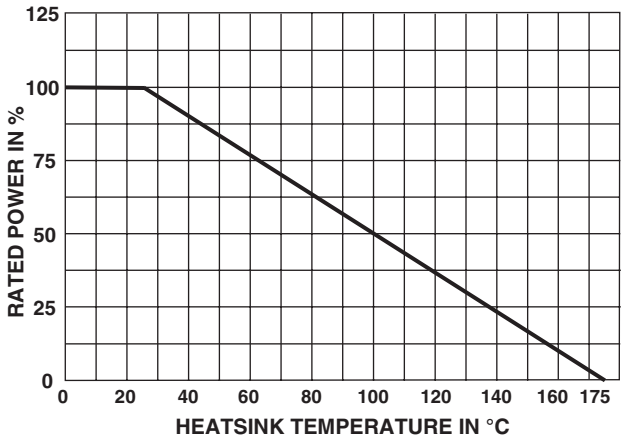
In any case the applied voltage must be lower than the maximum overload voltage of 560 V.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING

The temperature of the case should be maintained within the limits specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



MARKING

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

PACKAGING

Tube of 30 units

ORDERING INFORMATION

LTO	100	F	2.7 kΩ	± 1 %	xxx	TU30	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: Special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

L	T	O	1	0	0	F	2	7	0	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
LTO	**100**	**F** = Radial leads	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R4700** = 0.47 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Tube 30 pieces	**E3** = Pure tin

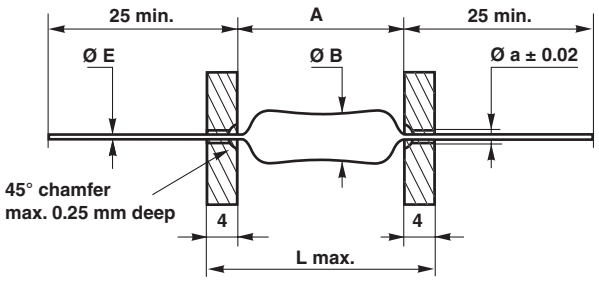
High Ohmic Values (up to 100 GΩ), High Voltage Resistors (up to 50 kV) Thick Film Technology

FEATURES

- RoHS for most values, please consult us
- Core: High purity ceramic
- Coating: Epoxy
- Termination: Standard lead material is solder coated copper
- Climatic category: - 55 °C/+ 155 °C/56 days
- High ohmic values: Up to 100 GΩ
- High voltage application: Up to 50 kV
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES	A	Ø B	Ø E ± 0.1	WEIGHT IN g
58	7 ± 0.2	1.6 ± 0.2	0.6	0.24
63	8.5 ± 0.5	22 ± 0.2		0.29
68	14 ± 1	3.5 ± 0.3	0.8	0.67
523	23 ± 2	4.5 ± 0.3		1.23
547	47 ± 2	4.5 ± 0.3		4.60
729	29 ± 2	6.5 ± 0.5		5.27
747	47 ± 2	4.5 ± 0.5		7.18
923	23 ± 2	8.5 ± 0.5		
932	32 ± 2			
947	47 ± 2			
972	72 ± 2			
9100	100 ± 2			

TECHNICAL SPECIFICATIONS

SERIES AND STYLES		HTS 58	HTS 63	HTS 68	HTS 523	HTS 547	HTS 729	HTS 747	HTS 923	HTS 932	HTS 947	HTS 972	HTS 9100
Power Rating at + 70 °C		0.25 W	0.5 W	1 W	1 W	1.5 W	2 W	2.5 W	2 W	2.5 W	3 W	4 W	5 W
Ohmic Range in Relation to • Temperature Coefficient ± 150 ppm/°C • Tolerance	± 0.5 %	200 Ω 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ	1 kΩ 100 MΩ
	± 1 %		1 kΩ 250 MΩ	1 kΩ 500 MΩ	1 kΩ 500 MΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ	1 kΩ 1 GΩ
	± 2 %	1 kΩ 200 MΩ	1 kΩ 500 MΩ	1 kΩ 2.5 GΩ	1 kΩ 5 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ	1 kΩ 10 GΩ
	± 5 % ± 10 %					1 kΩ 50 GΩ	1 kΩ 15 GΩ	1 kΩ 30 GΩ	1 kΩ 15 GΩ	1 kΩ 30 GΩ	1 kΩ 50 GΩ	1 kΩ 100 GΩ	1 kΩ 100 GΩ
Limiting Element Voltage		0.5 kV	1 kV	2 kV	5 kV	15 kV	10 kV	15 kV	8 kV	15 kV	20 kV	30 kV	50 kV
Critical Resistance		1 MΩ	2 MΩ	4 MΩ	25 MΩ	150 MΩ	50 MΩ	90 MΩ	32 MΩ	90 MΩ	133.3 MΩ	225 MΩ	500 MΩ

MARKING

GEKA trade-mark, series, style, nominal resistance (in Ω), tolerance (in %), letter P for TCR ± 150 ppm/°C, manufacturing date. Because of lack of space, small styles are marked with ohmic value (in Ω), tolerance (in %) and letter P.

ORDERING INFORMATION

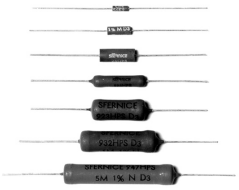
HTS	63	1M27	0.5 %	150 ppm/°C	AM500	e1
MODEL	SIZE	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT P: Standard: ± 150 ppm/°C	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

H	T	S	0	0	6	3	1	2	7	4	D	P	A	2	0

GLOBAL MODEL	STYLE	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING	SPECIAL
HTS	**HTS**: 58 to 9100	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **5104** = 5.1 MΩ **3303** = 330 kΩ **1276** = 127 MΩ ...	**D** = 0.5 % **F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**P** = 150 ppm **K** = 100 ppm	**B15** = Blister (20 pieces) **B19** = Blister (30 pieces) **A18** = Ammopack (400 pieces) **A20** = Ammopack (500 pieces) **B17** = Blister (25 pieces) **R10** = Reel (500 pieces) As applicable	As applicable

High Ohmic Value (up to 1.5 GΩ), High Power Resistors (up to 10 W at 25 °C) Thick Film Technology

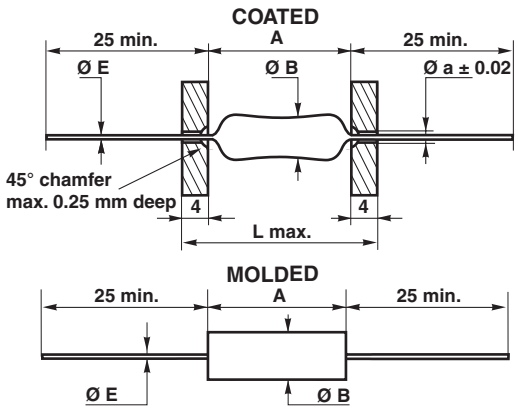


FEATURES

- RoHS for most values, please consult us
- High ohmic values up to 1.5 GΩ
- Power rating up to 10 W at + 25 °C
- Molded or coated
- Ceramic core
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES AND STYLE	A	Ø B	Ø E ± 0.1	WEIGHT g	FINISH
HPS58	6.5 ± 0.2	2.4 ± 0.1	0.6	0.24	molded
HPS63	10 ± 0.2	3.7 ± 0.1		0.29	
HPS68	15 ± 0.2	5.6 ± 0.3	0.8	0.67	
HPS523	23 ± 2.3	5 ± 0.3		1.23	coated
HPS923	23 ± 2.5	9 ± 0.5		4.60	
HPS932	32 ± 2.5	9 ± 0.5		5.27	
HPS947	47 ± 2.5	9 ± 0.5		7.18	

TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES AND STYLES	HPS 58	HPS 63	HPS 68	HPS 523	HPS 923	HPS 932	HPS 947
Power Rating at + 25 °C	1 W	2 W	3 W	4 W	6 W	8 W	10 W
Ohmic Range	200 Ω to 100 MΩ	200 Ω to 175 MΩ	300 Ω to 400 MΩ	800 Ω to 650 MΩ	1 kΩ to 1 GΩ	1 kΩ to 1 GΩ	2 kΩ to 1.5 GΩ
Tolerance	± 0.5 % to ± 10 %						
Temperature Coefficient	± 150 ppm/°C						
Limiting Element Voltage	0.3 kV	0.7 kV	1.5 kV	2 kV	2.5 kV	5 kV	8 kV
Critical Resistance	90 kΩ	245 kΩ	750 kΩ	1 MΩ	1.041 MΩ	3.125 MΩ	6.4 MΩ
Climatic Category	- 55 °C/+ 200 °C/56 days						

MARKING

GEKA trade-mark, series, style, nominal resistance (in Ω), tolerance (in %), letter P for TCR ± 150 ppm/°C, manufacturing date. Because of lack of space, small styles are marked with ohmic value (in Ω), tolerance (in %) and letter P.

ORDERING INFORMATION

HPS	68	50 MΩ	10 %	150 ppm/°C	BL20	e1
MODEL	SIZE	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

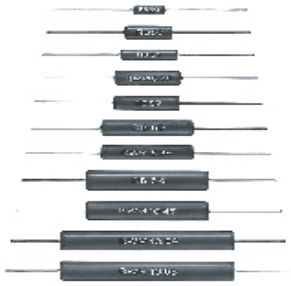
H	P	S	0	0	6	8	5	0	0	5	K	P	B	1	5

GLOBAL MODEL	STYLE	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING	SPECIAL
HPS	**HPS**: 58 to 947	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **1006** = 100 MΩ **5104** = 5.1 MΩ **3303** = 330 kΩ **5005** = 50 MΩ ...	**D** = 0.5 % **F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**P** = 150 ppm **K** = 100 ppm	**B15** = Blister (20 pieces) **B19** = Blister (30 pieces) **A18** = Ammopack (400 pieces) **A20** = Ammopack (500 pieces) **B17** = Blister (25 pieces) **R10** = Reel (500 pieces) As applicable	As applicable

Medium Power Axial Through Hole Wirewound Resistors

Contents

Enamelled Wirewound Power Resistors
Axial Leads



As a result of more than 50 years of experience and continuous improvements the RWM Series of resistors features proven reliability in AC or DC applications.
The high quality of the RWM resides mainly in the use of a proprietary Vishay Sfernice enamel fired at high temperature and free from any compound liable to corrode the resistive wire.

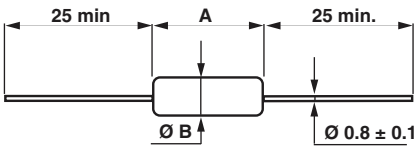
FEATURES

- High dissipation up to 30 W (25 °C)
- Fire proof
- Excellent endurance typical drift ± 1.5 % after 1000 h
- Conformal vitreous enamel
- All welded construction
- Low ohmic values 0.1 Ω available
- Termination: Sn/Ag/Cu
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

The performance of this series of professional resistors fully meets the requirements of the following specifications:
- NF C 83-210-001
- CECC 40201-001
- BS - CECC 40201-002

DIMENSIONS in millimeters



TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES AND STYLE		RWM 4 x 10	RWM 4 x 22	RWM 5 x 26	RWM 6 x 22	RWM 8 x 26	RWM 6 x 34	RWM 8 x 34	RWM 8 x 45	RWM 10 x 45	RWM 10 x 64	RWM 10 x 65
Designations	CECC 40201-001	RB59	RB61	RB57	RB57	RB60	RB60	RB58	RB58	-	-	-
	CECC 40201-002	JB	HB	-	KB	-	LB	-	MB	-	-	-
Power Rating	at + 70 °C	2.6 W	4.5 W	6 W	6 W	7 W	7 W	9.5 W	9.5 W	21 W	21 W	25.8 W
	at + 25 °C	3 W	5 W	7 W	7 W	8 W	8 W	11 W	11 W	25 W	25 W	30 W
	With Surface Temp. ≤ + 450 °C	5.5 W	7 W	10 W	10 W	10 W	12 W	14 W	20 W	25 W	25 W	30 W
Ohmic Range in Relation to Tolerance ± 5 % E24 Series		0.1 Ω 10 kΩ	0.1 Ω 16 kΩ	0.1 Ω 27 kΩ	0.1 Ω 39 kΩ	0.1 Ω 27 kΩ	0.33 Ω 36 kΩ	0.33 Ω 36 kΩ	0.47 Ω 62 kΩ	0.47 Ω 62 kΩ	0.68 Ω 100 kΩ	0.68 Ω 100 kΩ
Qualified Ohmic Range NF C 83-210		0.1 Ω 10 kΩ	0.1 Ω 6.8 kΩ	0.15 Ω 10 kΩ	0.15 Ω 39 kΩ	-	0.33 Ω 15 kΩ	-	0.47 Ω 33 kΩ	-	-	-
Limiting Element Voltage		120 V	300 V	350 V	350 V	500 V	500 V	650 V	650 V	800 V	800 V	800 V
Critical Resistance		4.8 kΩ	-	18.8 kΩ	17.5 kΩ	-	31 kΩ	-	38 kΩ	25.6 kΩ	25.6 kΩ	21.3 kΩ
Dimensions in mm	A	12 ± 1	22.1 ± 1	24.7 ± 1	18 ± 1	24.7 ± 1	33.7 ± 1	33.7 ± 1	45.8 ± 2	45.8 ± 2	63.8 ± 1	63.8 ± 1
	Ø B	5.5 ± 1	5.5 ± 1	7.4 ± 1.5	6.5 ± 1	7.4 ± 1.5	7.4 ± 1.5	7.4 ± 1.5	9.4 ± 1.5	9.4 ± 1.5	9.4 ± 1.5	9.4 ± 1.5
Weight in g		1	2	3	2.2	3	4	4	8	8	14	14

Note
• Undergoes European Quality Insurance System (CECC)

PERFORMANCE			
CECC 40201 - EN 140-201			TYPICAL DRIFTS
TESTS	CONDITIONS	REQUIREMENTS	
Short Time Overload	10 P_r during 10 s 25 °C ambient	± (2 % + 0.1 Ω)	± (0.5 % + 0.05 Ω)
Temperature Cycling	- 55 °C + 200 °C	± (1 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)
Humidity (Steady State)	56 days 40 °C ambient - R.H. 95 %	± (5 % + 0.1 Ω)	± (0.5 % + 0.05 Ω)
Terminal Strength	Tensile test: 20 N 2 successive bending 2 full rotations of 180°	± (1 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Load Life	1000 h at P_r 90'/30' cycle 25 °C ambient	± (5 % + 0.1 Ω)	± (1.5 % + 0.05 Ω)

OVERLOAD

Heavy overloads can be endured in the form of short pulses < 0.1 s. Particular requirements should be submitted to Vishay Sfernice, specifying peak voltage, cycle and environmental conditions.

RECOMMENDATIONS FOR USE

Since these components are high dissipation power resistors, customers are advised to use a high melting point solder.

For low ohmic values, the measurement becomes critical and the connecting wires resistance is to be included. The value is measured at 5 mm from the resistor body.

Group Mounting

In a still atmosphere, a distance between axes equal to five times the resistor's diameter is recommended.

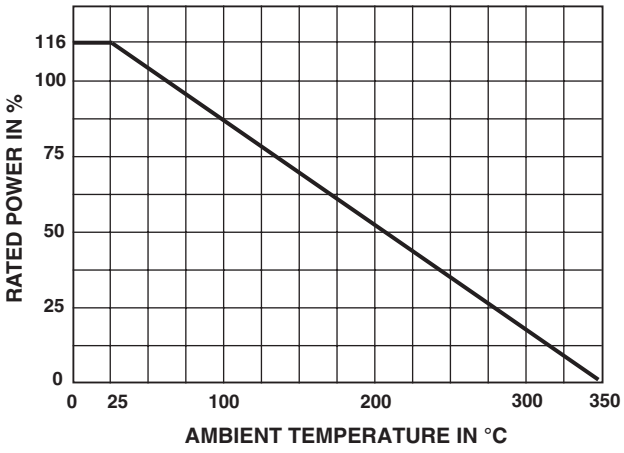
Cabinet Mounting

- Unventilated box: Dissipation should be reduced (see dimensional drawing).
- Forced ventilation: If conditions are appropriate, dissipation may be doubled or even trebled.
- In any case: The surface temperature at the hottest point should not exceed 450 °C.

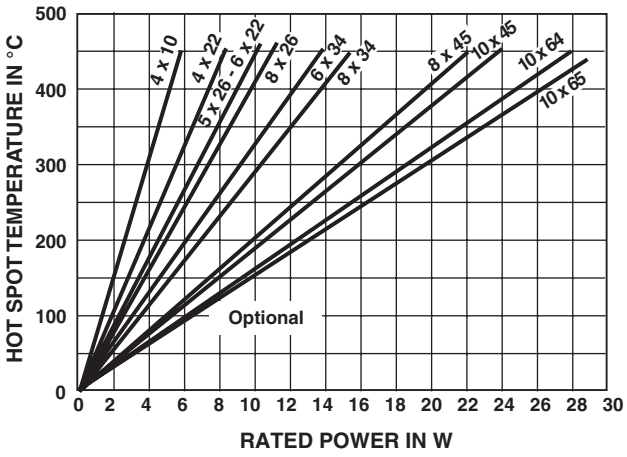
These aspects should be considered by the end user.

ELECTRICAL SPECIFICATIONS		
Tolerance	**Standard**	± 5 %
	On request	± 1 % and ± 2 %
Temperature Coefficient + 75 ppm/°C typical		
Dielectric Withstanding Voltage NF EN140000		500 V_{RMS} - 1 min - 10 mA
Inductance		Non inductive (Ayrton-Perry) winding available

POWER RATING



TYPICAL TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model and style, CECC style, if applicable (except for the smallest model due to lack of space: (4 x 10 or RB 59), ohmic value, resistance tolerance, manufacturing date (year - month).

ORDERING INFORMATION

RWM	4 x 10		XXX	1U2	± 5 %	AM500	e1
MODEL	STYLE	NI OPTIONAL	SPECIAL DESIGN	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
		Non Inductive Winding	Method N° Optional	Custom items are subject to extra charge and minimum order. Please see price list.			

GLOBAL PART NUMBER INFORMATION

R	W	M	0	4	1	0		1	R	2	0	J	R	1	5		E	1

GLOBAL MODEL	SIZE	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL	LEAD (Pb)-FREE
RWM	d x L: **0410** **0422** **0526** **0826** **0634** **0845** **1045** **1064** **1065**	**Blank** or **N** (Non inductive winding)	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R7** = 48.7 Ω **1R20** = 1.2 Ω **1002** = 10 000 Ω **R330** = 0.33 Ω ...	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	Size 0410, 0422, 0526, 0826, 0622: **R15** = Reel (1000 pieces) Size 0845, 1045, 1064, 1065: **B25** = Box (50 pieces) Size 0634: **S09** = Bag (50 pieces) Other packaging existing	As applicable Ex: **AD7**	Sn(99), Ag(0.3), Cu(0.7): **E1**

Insulated Precision Wirewound Resistors Axial Leads

In wirewound precision resistors, the RLP series holds a leading position in professional applications whenever an excellent stability of the ohmic value and a correspondingly low temperature coefficient are required at the same time.

The RLP model resistors comply with the most stringent requirements of the CECC 40-201-006 specification. The series consists of 5 models covering the power range from 1 W to 10 W.

Non-inductive versions can be supplied on request by specifying RLP-NI. For higher power dissipations, the use of RH series resistors is recommended.

FEATURES

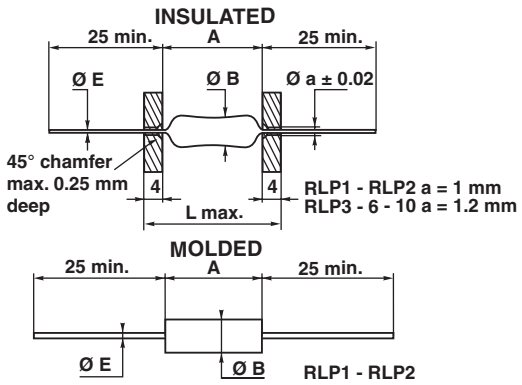
- 1 W to 10 W at 25 °C
- Approved according to CECC 40-201-006
- According to MIL-R-26/5C and MIL-R-26/6C
- Excellent stability < ± 0.3 % after 1000 h
- High power up to 10 W at 25 °C
- Low ohmic values 10 mΩ available
- Low temperature coefficient ≤ ± 50 ppm/°C
- Electrical insulation
- Climatic protection
- Termination = Pure matte tin or Sn/Ag/Cu according to the ohmic value
- Compliant to RoHS directive 2002/95/EC

Pb-free

e1

RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES AND STYLE	A max.	Ø B max.		E ± 0.1	WEIGHT g
		R > 0.15 Ω	R ≤ 0.15 Ω		
RLP1	7	2.5	-	0.6	0.27
RLP2	10.2	4.0	6	0.6	0.48
RLP3	14	5.54	9	0.8	1.3
RLP6	23.82	8.71	11	0.8	3.4
RLP10	46.78	10.32	180K	0.8	8.6

TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES AND STYLE			RLP1	RLP2	RLP3	RLP6	RLP10
Reference CECC 40-201-006			A	B	C	D	E
Cross-Reference NF C 93-210			RP8	RP7	RP4	RP5	RP6
Cross-Reference MIL-R-26/5C and MIL-R-26/6C			RW80	RW81	RW79	RW74	RW78
Power Rating, P_r	CECC 40-201-006 Power	At 25 °C, P_{25} At 70 °C, P_{70}	1 W 0.8 W	1.5 W 1.25 W	2.5 W 2 W	-	-
	Extended Sfernice Power	At 25 °C, P_{25} At 70 °C, P_{70}	1 W 0.8 W	2 W 1.65 W	3 W 2.5 W	6 W 5 W	10 W 8.2 W
Ohmic Range in Relation to Tolerance		± 5 % E24	0.05 Ω to 2 kΩ	0.025 Ω to 6.8 kΩ	0.01 Ω to 15 kΩ	0.02 Ω to 59 kΩ	0.06 Ω to 150 kΩ
		± 2 % E48	0.05 Ω to 2 kΩ	0.025 Ω to 6.8 kΩ	0.03 Ω to 15 kΩ	0.02 Ω to 59 kΩ	0.06 Ω to 150 kΩ
		± 1 % E96	0.05 Ω to 2 kΩ	0.025 Ω to 6.8 kΩ	0.03 Ω to 15 kΩ	0.02 Ω to 59 kΩ	0.06 Ω to 150 kΩ
		± 0.5 % E96	0.4 Ω to 2 kΩ	0.4 Ω to 6.8 kΩ	0.0499 Ω to 15 kΩ	0.3 Ω to 59 kΩ	0.3 Ω to 150 kΩ
		± 0.1 % E96	Please consult Vishay Sfernice				
Qualified Ohmic Value Range CECC 40-201-006			1 Ω to 470 Ω	0.2 Ω to 1.78 kΩ	0.1 Ω to 3.57 kΩ	0.1 Ω to 12.1 kΩ	0.1 Ω to 40.2 kΩ
Limiting Element Voltage, $U_{max.}$ AC/DC			50 V	120 V	200 V	300 V	720 V
Critical Resistance			Out of nominal ohmic range			17 800 Ω	51 100 Ω

Note

- Undergoes European Quality Insurance System (CECC)

MECHANICAL SPECIFICATIONS		
Series and Style	RLP1, RLP2	RLP3, RLP6, RLP10
Encapsulant	High temperature mold compound	High temperature silicone coating
Resistive Element	CuNi or NiCr	
Ceramic Substrate	Alumina or steatite	
Termination	Pure matte tin or Sn/Ag/Cu	

ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	- 55 °C to 275 °C
Climatic Category (LCT/UCT/days)	55/200/56

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS (ΔR/R OR INDICATED PARAMETER) CECC 40-201-006**
Short Time Overload	IEC 60115-1 6.25 $P_{r\ \text{Extended Sfernice Power}}$ or $U = 2\ U_{max.}/5$ s for RLP1, RLP2, RLP3 12 $P_{r\ \text{Extended Sfernice Power}}$ or $U = 2\ U_{max.}/5$ s for RLP6, RLP10	± (0.25 % + 0.05 Ω)
Load Life	IEC 60115-1 90'/30' CYCLES 1000 h $P_{r\ \text{Extended Sfernice Power}}$ + 25 °C	± (0.5 % + 0.05 Ω) Insulation R ≥ 1 GΩ
Dielectric w/s Voltage	IEC 60115-1 U_{RMS} = 500 V/60 s for RLP1, RLP2, RLP3 U_{RMS} = 1000 V/60 s for RLP6, RLP10	No flashover or breakdown Leakage current < 10 µA
Rapid Change of Temperature	IEC 60115-1 IEC 60068-2-14 Test Na 5 cycles (30' at LCT/30' at UCT) - 55 °C/+ 200 °C	± (0.25 % + 0.05 Ω)
Climatic Sequence	IEC 60115-1 - 55 °C/+ 200 °C/56 days	± (0.5 % + 0.05 Ω)
Humidity (Steady State)	IEC 60115-1 IEC 60068-2-3 Test Ca 95 % HR/40 °C 56 days	± (0.5 % + 0.05 Ω) Insulation R ≥ 100 MΩ
Shock	IEC 60115-1 IEC 60068-2-27 Test Ea 50 *g*'s/half sine/ 3 times by direction (i.e. 18 shocks)	± (0.25 % + 0.05 Ω)
Vibration	IEC 60115-1 IEC 60068-2-6 Test Fc 10 Hz/55 Hz	± (0.25 % + 0.05 Ω)
Load Life at Upper Category Temperature	IEC 60115-1 90'/30' cycles 1000 h $P_{r\ \text{Extended Sfernice Power}}$ + 200 °C	± (0.5 % + 0.05 Ω) Insulation R ≥ 1 GΩ

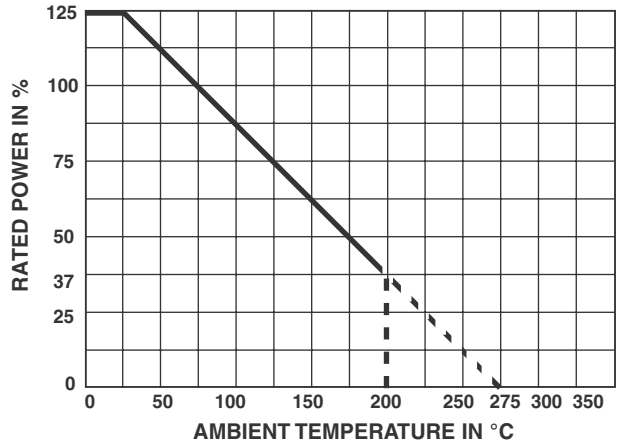
TEMPERATURE COEFFICIENT IN THE RANGE - 55 °C TO + 200 °C	
OHMIC RANGE	**REQUIREMENT CECC 40-201-006**
< 1 Ω	± 100 ppm/°C
1 Ω to < 10 Ω	± 50 ppm/°C
≥ 10 Ω	± 25 ppm/°C

STABILITY AND POWER RATING

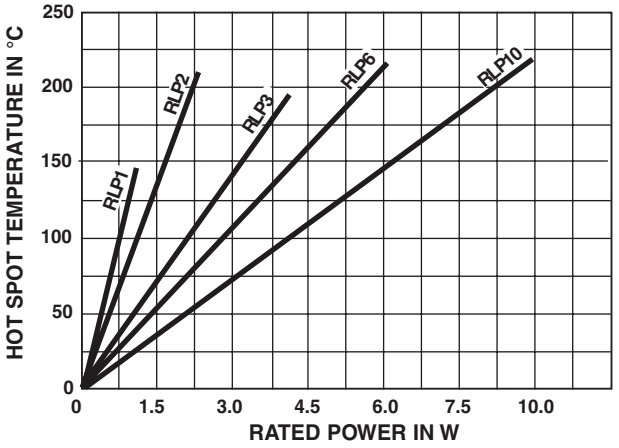
Stability changes slightly according to power rating and ambient temperature. This fact is especially important for users needing a life drift lower than the initial resistance tolerance. Typical drifts, after 2000 h life test made under the 90'/30' conditions and at an ambient temperature of 25 °C, are:

OHMIC RANGE	RLP1	RLP2	RLP3	RLP6	RLP10	ΔR %/R %
P_n	1 W	2 W	3 W	5 W	10 W	0.3
0.5 P_n	0.5 W	1 W	1.5 W	2.5 W	5 W	0.15

POWER RATING



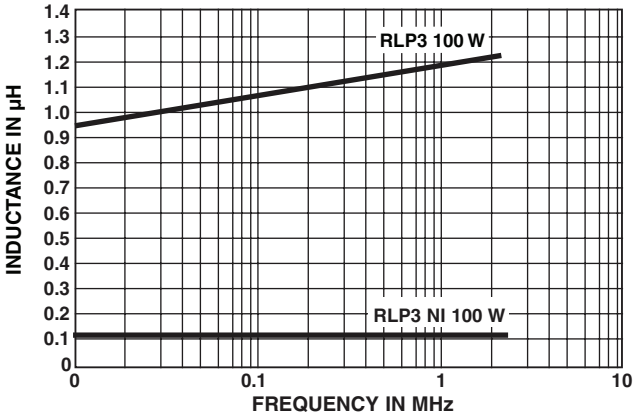
TEMPERATURE RISE



NON INDUCTIVE WINDING (NI)

Non inductive (Ayrton Perry) winding available.
Please consult Vishay Sfernice.

INDUCTANCE (Example)



PACKAGING (see datasheet 50032 and 50033)

Reel of 1000 units for RLP1, RLP2, RLP3
Ammopack of 500 units for RLP1, RLP2, RLP3
Bag of 100 units for RLP1, RLP2
Blister of 20 units for RLP3
Box of 50 units for RLP6, RLP10

MARKING

Vishay Sfernice trademark, series, style, CECC style (if applicable) nominal resistance (in Ω, kΩ), tolerance (in %), manufacturing date.

ORDERING INFORMATION

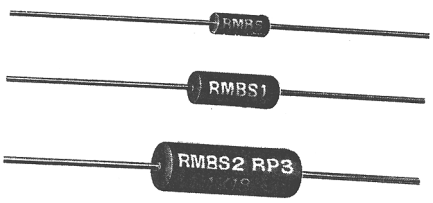
RLP	01	5R500	J	R15
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING

GLOBAL PART NUMBER INFORMATION

R	L	P	0	6	1	5	0	R	0	J	B	0	0

GLOBAL MODEL	SIZE	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RLP	**01** **02** **03** **06** **10**	**N** = Non inductive winding	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **680R0** = 680 Ω **20301** = 20.3 kΩ **88R88** = 88.88 Ω ...	**B** = 0.1 % **c** = 0.2 % **D** = 0.5 % **F** = 1 % **G** = 2 % **J** = 5 %	**Standard Packaging:** Size 01 and 02: S14 = Bag, 100 pieces Size 03: B15 = Bulk, 20 pieces Size 06 and 10: B25 = Box, 50 pieces	As applicable **Ex** = MEX

Molded Precision Wirewound Resistors
Axial Leads



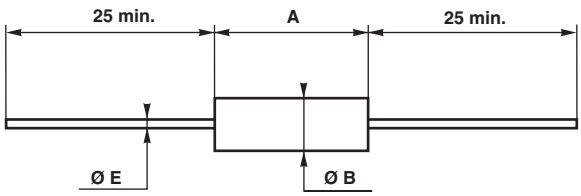
FEATURES

- 0.75 W to 3 W at 25 °C
- NF C 83-210
- CECC 40201-005
- Low temperature coefficient ≤ ± 50 ppm/°C
- Low ohmic values 15 mΩ available
- Excellent behavior against humidity
- Electrical insulation
- Mechanical strength
- Accurate sizes
- Termination = Sn/Ag/Cu or pure matte tin according to the ohmic value
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS
COMPLIANT

High stability and low temperature coefficient are the main features of the precision wirewound resistors type RMB RMBS models just as maintenance parts. Their performances can be compared with those of the best film resistors but they have in addition a greater power rating. RMBS styles meet the more severe requirements of NF C 83-210 (all RMBS styles are approved) and characteristic U of MIL-R-26 E (approximate size of RW 70 and 79 resistors) specifications. The two models RMB and RMBS have a similar construction. RMBS are submitted, in addition to a process which further increases the stability. On request, non-inductive resistors are available under the reference RMB NI.

DIMENSIONS in millimeters



SERIES AND STYLE	A max.	Ø B max.	E ± 0.1	WEIGHT g
RMB0.75 RMBS0.5	7	2.5	0.6	0.3
RMB1.5 RMBS1	10.2	4	0.6	0.7
RMB3 RMBS2	16.2	6.4	0.8	1.5

TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES AND STYLE		RMB0.75	RMB1.5	RMB3	RMBS0.5	RMBS1	RMBS 2
NF C 83-210		-	-	-	RP1	RP2	RP3
CECC 40201-005		-	-	-	A	B	C
Power Rating	at 25 °C	0.75 W	1.5 W	3 W	0.5 W	1 W	2 W
	at 70 °C	0.6 W	1.2 W	2.4 W	0.4 W	0.8 W	1.6 W
Ohmic Range in Relation to Tolerance	± 5 % E24	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.051 Ω to 13 kΩ	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.015 Ω to 13 kΩ
	± 2 % E48	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.08 Ω to 12.3 kΩ	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.078 Ω to 12.4 kΩ
	± 1 % E96	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.1 Ω to 12.4 kΩ	0.1 Ω to 2 kΩ	0.1 Ω to 6.81 kΩ	0.1 Ω to 12.4 kΩ
	± 0.5 % E96	0.4 Ω to 2 kΩ	0.4 Ω to 6.81 kΩ	0.3 Ω to 12.4 kΩ	0.4 Ω to 2 kΩ	0.4 Ω to 6.81 kΩ	0.3 Ω to 12.4 kΩ
	± 0.1 %	Please consult Vishay Sfernice					
Qualified Ohmic Range NF C 83-210		-	-	-	1 Ω to 174 Ω	1 Ω to 590 Ω	1 Ω to 1.3 kΩ
Limiting Element Voltage		Not applicable	120 V	200 V	Not applicable	120 V	200 V
Critical Resistance		Out of nominal ohmic range					

Note

- Undergoes European Quality Insurance System (CECC)

PERFORMANCE					
TESTS	CONDITIONS	REQUIREMENTS		TYPICAL VALUES AND DRIFTS	
		MIL-R-26 E	NF C 83-210	RMB	RMBS
Dielectric W/s Voltage	500 V_{RMS}	± (0.1 % + 0.05 Ω)	-	± (0.05 % + 0.01 Ω)	± (0.05 % + 0.01 Ω)
Short Time Overload	5 P_n at 25 °C/5 s	± (0.2 % + 0.05 Ω)	± 0.25 % + 0.05 Ω	± (0.1 % + 0.01 Ω)	± (0.05 % + 0.01 Ω)
Climatic Sequence	NF C 83-210 - 55 °C/+ 200 °C 5 cycles	-	± 0.25 % + 005 Ω Insulation R > 100 MΩ	± (0.1 % + 0.01 Ω) > 10^4 MΩ	± (0.05 % + 0.01 Ω) > 10^4 MΩ
Humidity (Steady State)	NF C 83-210 56 days 95 % RH	-	± 0.25 % + 0.05 Ω Insulation R > 100 MΩ	± (0.1 % + 0.01 Ω) > 10^4 MΩ	± (0.05 % + 0.01 Ω) > 10^4 MΩ
Thermal Shock	Load at 100 % P followed by cold temp. exposure at - 55 °C	± (0.2 % + 0.05 Ω)	-	± (0.2 % + 0.01 Ω)	(0.1 % + 0.01 Ω)
Vibration	MIL-STD-202 Method 204 - Test D: 20 g 10/2000 Hz	± (0.2 % + 0.05 Ω)	± 0.25 % + 0.05 Ω	± (0.01 % + 0.01 Ω)	± (0.01 % + 0.01 Ω)
Load Life	MIL-STD-202 Method 108 Pr 2000 h	± (0.5 % + 0.05 Ω)	± 0.25 % + 0.05 Ω 1000 h at 25 °C	± (1 % + 0.01 Ω)	± (0.15 % + 0.01 Ω)
Moisture Resistance	MIL-STD-202 Method 106	± (0.2 % + 0.05 Ω) Insulation resistance > 100 MΩ	-	± (0.1 % + 0.01 Ω) > 10^3 MΩ	± (0.05 % + 0.01 Ω) > 10^3 MΩ
High Temperature	1000 h at + 200 °C	± (0.5 % + 0.05 Ω)	± 0.5 % + 0.05 Ω Insulation R > 1 GΩ	± 1 %	± 0.3 %
Shock	MIL-STD-202 100 *g* Method 205 Test C	± (0.1 % + 0.05 Ω)	± 0.25 % + 0.05 Ω	± 0.05 %	± 0.05 %

TEMPERATURE COEFFICIENT IN THE RANGE - 55 °C TO + 200 °C		
OHMIC RANGE	REQUIREMENTS NF C 83-210 MIL-R-26E	TYPICAL VALUES SFERNICE
	MIL	
R_n < 1	≤ ± 100 ppm/°C	± 50 ppm/°C
1 ≤ R_n < 10	≤ ± 50 ppm/°C	
R_n ≥ 10	≤ ± 25 ppm/°C	+ 0 °C to - 20 ppm/°C

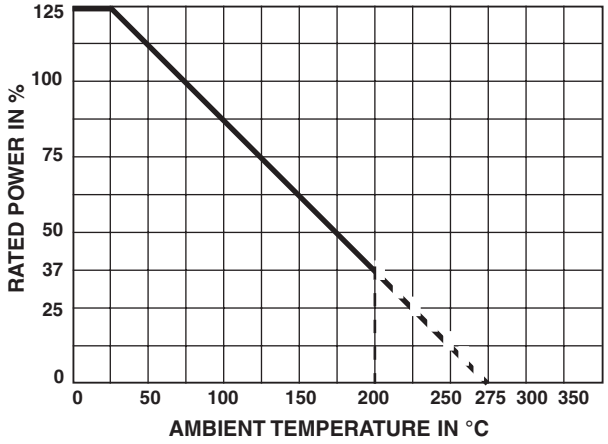
STABILITY AND POWER RATING

Stability changes slightly according to power rating and ambient temperature. This fact is specially important for users needing a life drift lower than the initial resistance tolerance. Typical drifts, after 2000 h life test made under the 90'/30' conditions and at a 25 °C ambient temperature are:

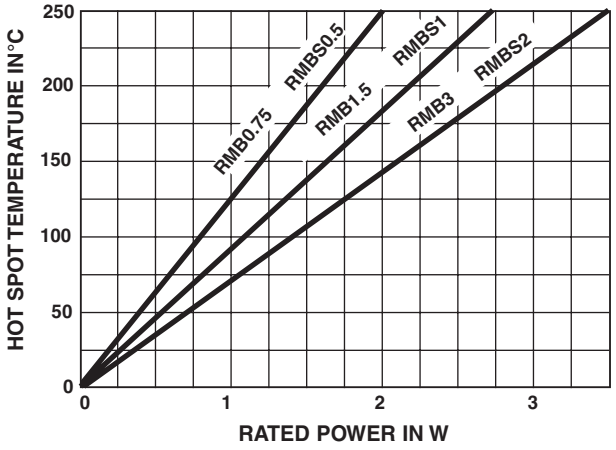
MODEL STYLE	RMBS 0.5	RMBS 1	RMBS 2	*R* %/*R* %	MODEL STYLE	RMB 0.75	RMB 1.5	RMB 3	*R* %/*R* %
P_n	0.5 W	1 W	2 W	0.15 %	$P_{max.}$	1 W	2 W	3.5 W	1 %
1/2 P_n	0.25 W	0.5 W	1 W	0.075 %	P_n	0.75 W	1.5 W	3 W	0.5 %
					1/3 P_n	0.4 W	0.75 W	1.5 W	0.3 %

Molded Precision Wirewound Resistors
Axial Leads

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, CECC style (if applicable) nominal resistance (in Ω), tolerance (in %), manufacturing date.

ORDERING INFORMATION

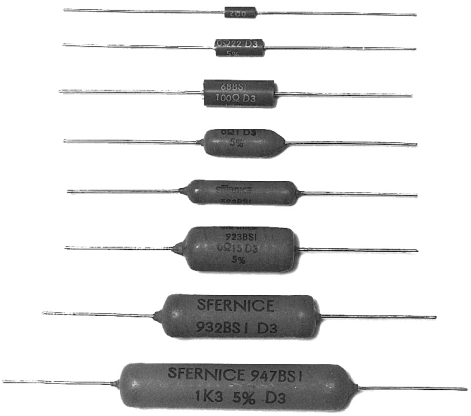
RMB	**105**	**R5000**	**J**	**S00**
RMBS	**05**	**22R00**	**J**	**S14**
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING

GLOBAL PART NUMBER INFORMATION

R	M	B	1	0	5	3	0	0	R	0	J	S	0	0

GLOBAL MODEL	SIZE	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RMB **RMBS**	**RMB:** 075 105 300 **RMBS:** 05 10 20	**N** = Non inductive winding	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **300R0** = 300 Ω **680R0** = 680 Ω **20301** = 20.3 kΩ **88R88** = 88.88 Ω ...	**F** = 1 % **J** = 5 %	**Standard Packaging:** **RMB:** Size 075 and 105: S14 = Bag, 100 pieces Size 300: S09 = Bag, 50 pieces **RMBS:** Size 05 and 10: S14 = Bag, 100 pieces Size 20: S09 = Bag, 50 pieces **Other packagings available**	As applicable **Ex** = MEX

Molded and Insulated Wirewound Power Resistors
Axial Leads

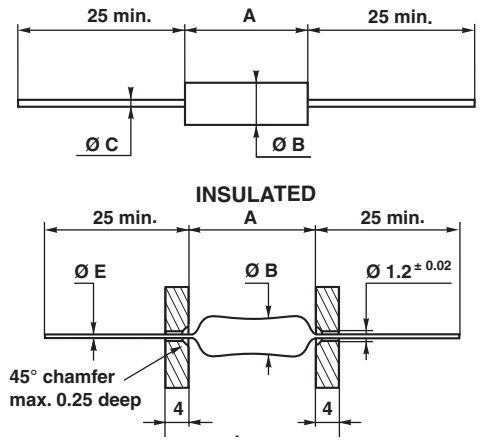


FEATURES

- 1 W to 10 W
- Excellent stability = Typical drift ± 1 % after 2000 h
- High power = Up to 10 W (25 °C)
- Low ohmic values = 0.01 Ω available
- Electrical insulation
- Climatic protection
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



MOLDED	PROTECTION			
SERIES AND STYLE	A	Ø B	Ø C ± 0.1	WEIGHT g
58BSI	6.5 ± 0.2	2.4 ± 0.1	0.6	0.3
63BSI	10 ± 0.2	3.7 ± 0.1		0.45
68BSI	15 ± 0.5	5.6 ± 0.2	0.8	1.3
INSULATED	PROTECTION			
516BSI	17 ± 2	5 ± 1	0.8	1.6
523BSI	24 ± 2	5 ± 1		2.5
923BSI	26 ± 2	9 ± 1		6
932BSI	34 ± 3	9 ± 1		7.5
947BSI	51 ± 3	9 ± 1		10

TECHNICAL SPECIFICATIONS

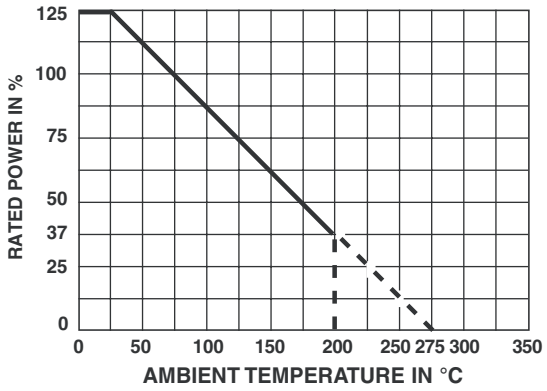
VISHAY SFERNICE SERIES			58BSI	63BSI	68BSI	516BSI	523BSI	923BSI	932BSI	947BSI
Power Rating at + 25 °C			1 W	2 W	3 W	4 W	5 W	6 W	8 W	10 W
Ohmic Range			0.1 Ω to 2 kΩ	0.025 Ω to 4 kΩ	0.01 Ω to 15 kΩ	0.01 Ω to 20 kΩ	0.015 Ω to 40 kΩ	0.02 Ω to 60 kΩ	0.035 Ω to 100 kΩ	0.06 Ω to 150 kΩ
Ohmic Range in Relation to Temperature Coefficient	± 100 ppm/°C	± 0.5 % ± 5 %	0.1 Ω 2 kΩ	0.1 Ω 4 kΩ	0.1 Ω 15 kΩ	0.1 Ω 20 kΩ	0.1 Ω 40 kΩ	0.1 Ω 60 kΩ	0.1 Ω 100 kΩ	0.1 Ω 150 kΩ
	± 300 ppm/°C	± 1 % ± 5 %	-	0.025 Ω < 0.1 Ω	0.01 Ω < 0.1 Ω	0.01 Ω < 0.1 Ω	0.015 Ω < 0.1 Ω	0.02 Ω < 0.1 Ω	0.035 Ω < 0.1 Ω	0.06 Ω < 0.1 Ω
Limiting Element Voltage			50 V	120 V	200 V	200 V	250 V	300 V	500 V	750 V

MECHANICAL SPECIFICATIONS	
Mechanical Protection	Molded or painted (insulated)
Resistive Element	CuNi or CrNi
Substrate	Alumina
Connections	Sn/Ag/Cu 99/0.3/0.7

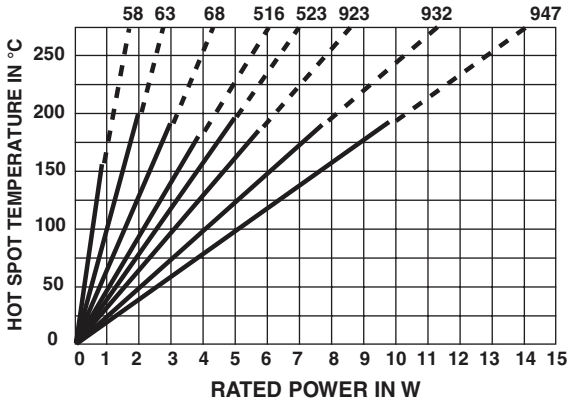
ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	- 55 °C to + 275 °C
Climatic Category	55/200/56

PERFORMANCE			
TESTS	**CONDITIONS**	**REQUIREMENTS**	**TYPICAL VALUES AND DRIFTS**
Dielectric Strength	IEC 60115-1 1000 V_{RMS} for 923...947 500 V_{RMS} for 58...523	± (0.1 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Short Time Overload	IEC 60115-1 5 P_n/5 s for P_r < 5 W 10 P_n/5 s for P_r ≥ 5 W	± (0.2 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Endurance	IEC 60115-1 90'/30' P_r at 25 °C, 2000 h	± (1 % + 0.05 Ω)	± (1 % + 0.05 Ω)
Endurance at High Temperature	250 h at 275 °C	± (0.5 % + 0.05 Ω)	± (0.3 % + 0.05 Ω)
Thermal Shock	Load at 100 % P_r followed by cold temp. exposure at - 55 °C	± (0.2 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Climatic Sequence	IEC 60115-1 - 55 °C/+ 200 °C 5 cycles	± (0.5 % + 0.05 Ω) Insulation resistance ≥ 100 MΩ	± (0.3 % + 0.05 Ω) Insulation resistance > 10 GΩ
Damp Heat, Steady State	IEC 60115-1/IEC 60068-2-78 56 days, 40 °C, 93 % RH	± (0.5 % + 0.05 Ω) Insulation resistance ≥ 100 MΩ	± (0.3 % + 0.05 Ω) Insulation resistance > 10 GΩ
Moisture Resistance	MIL-STD-202 Method 106	± (0.2 % + 0.05 Ω) Insulation resistance > 100 MΩ	± (13 % + 0.05 Ω) Insulation resistance > 10 GΩ
Shock	MIL-STD-202 100 *g* Method 205 - Test C	± (0.1 % + 0.05 Ω)	± (0.05 % + 0.05 Ω)
Vibration	MIL-STD-202 Method 204 - Test D: 20 g 10Hz/2000 Hz	± (0.1 % + 0.05 Ω)	± (0.05 % + 0.05 Ω)

POWER RATING



TEMPERATURE RISE



MARKING

GEKA trademark, model, style, nominal resistance (in Ω), tolerance (in %), manufacturing date.
Because of lack of space, small styles are marked with ohmic value (in Ω), and tolerance (in %) only.

ORDERING INFORMATION

BSI	63	U22	2 %	± 100 ppm/°C	TR300	e1
MODEL	STYLE	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

B	S	I	0	6	3	2	R	8	7	0	F	R	2	2	

GLOBAL MODEL	SIZE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
BSI	**058** **063** **068** **516** **523** **923** **932** **947**	The first digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2R870** = 2.87 Ω **1R200** = 1.2 Ω **10020** = 10 000 Ω **R3300** = 0.33 Ω ...	**D** = 0.5 % **F** = 1 % **G** = 2 % **J** = 5 %	Size 058, 063: **R22** = Reel (3000 pieces) **R17** = Reel (1250 pieces) **A22** = AM (1000 pieces) Size 516, 523, 923, 932: **A15** = AM (250 pieces) **B19** = Bulk (30 pieces) Other packaging existing	As applicable Ex = **AD7**

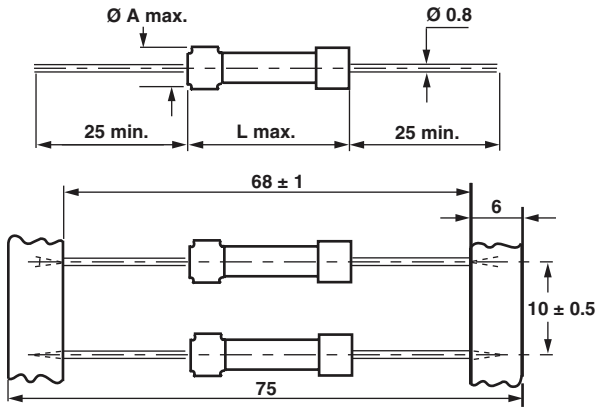
Cemented Wirewound Resistors

FEATURES

- 3 W and 4 W at + 40 °C
- Cemented protection
- Non flammability
- Industrial applications
- Compliant to RoHS directive 2002/95/EC
- Low values available: 10 mΩ available (for SG3)
  100 mΩ available (for SG4)

Pb-free
RoHS
COMPLIANT

DIMENSIONS in millimeters (max.)



MODEL	Ø A	L
SG3	5 (5.2 for ≤ 0.2 Ω)	13
SG4	5.5 (5.8 for ≤ 0.5 Ω)	15.8

MECHANICAL SPECIFICATIONS

Mechanical Protection	Cement
Resistive Element	Ni Cr wire
Connections	Copper tinned

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 250 °C
Climatic Category	55/250/21

ELECTRICAL SPECIFICATIONS

	SG3	SG4
Ohmic Range	0.01 Ω to 3.3 kΩ	0.02 Ω to 3.9 kΩ
Standard Tolerance	± 5 %	
Power Rating at + 40 °C	3 W	4 W
Limiting Element Voltage	100 V	125 V
Critical Resistance	3.3 kΩ	3.9 kΩ
Temperature Coefficient (typical)	VΩ < 0.1 Ω 300 ppm/°C	
Temperature Coefficient (typical)	VΩ ≥ 0.1 Ω 150 ppm/°C	

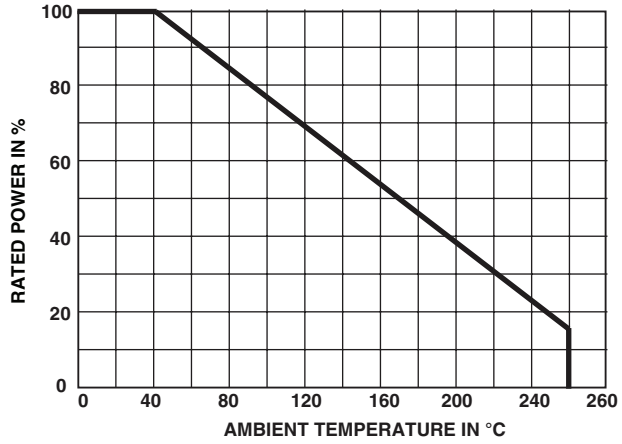
PERFORMANCE

TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS
Short Time Overload	5 P_n during 5 s	± (1.5 % + 0.005 Ω)
Rapid Change of Temperature	EN1400 CEI-115-1 - 55 °C + 200 °C 5 cycles	± (1 % + 0.005 Ω)
Humidity	EN60115-1 56 days 93 % RH	± (1 % + 0.005 Ω)
Load Life	MIL-STD 202 Method 108 P_r 1000h	± (5 % + 0.005 Ω)
Moisture Resistance	MIL-STD 202 Method 106	± (1 % + 0.005 Ω)
Vibration	MIL-STD 202 Method 204 Test 20 *g* 10 Hz/2000 Hz	± (0.5 % + 0.005 Ω)
Shock	MIL-STD 202 Method 213 Test C	± (0.5 % + 0.005 Ω)

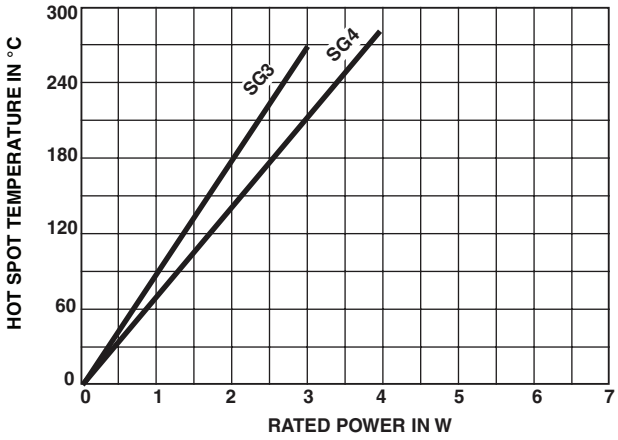
SPECIAL FEATURES

Please consult Vishay Sfernice for other ohmic values and tolerances.

POWER RATING



TEMPERATURE RISE



MARKING

GEKA trademark, model, style, nominal resistance (in Ω), tolerance (in %).
Note: For low ohmic values, (< 0.1 Ω), quality of marking cannot be guaranteed.

PACKAGING

Tape and reel packaging by:
- 1500 pieces SG3
- 1250 pieces SG4

ORDERING INFORMATION

SG	3	330 Ω	± 5 %	± 150 ppm/°C	TR1500	e3
MODEL	STYLE 3 4	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT ± 300 ppm/°C	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

S	G	3	R	0	3	0	0	J	R	1	8			

GLOBAL MODEL

SG

SIZE

3
4

OHMIC VALUE

The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.

R0300 = 0.03 mΩ
2R870 = 2.87 Ω
1R200 = 1.2 Ω
10020 = 10 000 Ω
R3300 = 0.33 Ω

TOLERANCE

J = 5.0 %

PACKAGING

R17 = reel 1250 pieces

R18 = reel 1500 pieces

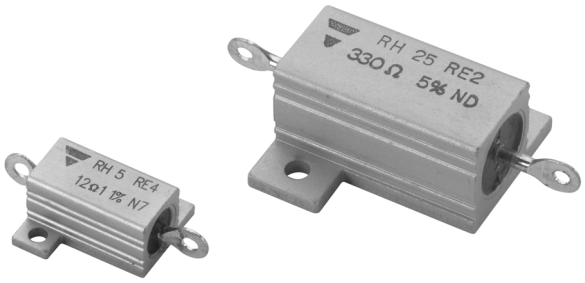
SPECIAL

As applicable.
Example: **AD7**

High Power Wirewound Resistors

Contents

Heatsink Encased Wirewound Power Resistors



FEATURES

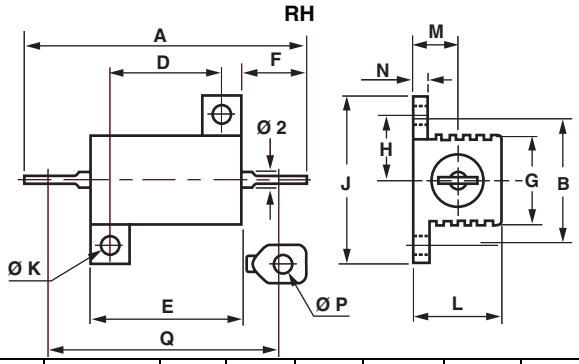
- 5 W to 50 W at 25 °C
- NF C 83-210
- CECC 40 203
- High stability < 0.05 % year
- Low temperature coefficient typically ± 15 ppm/°C
- Wide range of values from 0.006 Ω to 130 kΩ
- Termination = Sn/Ag/Cu
- Compliant to RoHS directive 2002/95/EC

Pb-free RoHS COMPLIANT

Encased in a compact and light heatsink offering complete environmental protection, great mechanical strength and easy mounting. Non inductive versions can be supplied under the RHNI designation (please indicate required specifications and frequency range upon ordering).

NF F 16101, 10/1988 and 16102, 04/1992: Not applicable (our parts contain less than 10 g of combustible materials).

DIMENSIONS in millimeters



SERIES	A	B ± 0.2	D ± 0.2	E ± 0.5	F	G ± 1	H ± 0.7	J ± 0.5	Ø K ± 0.1	L MAX.	M ± 0.5	N ± 0.3	Ø P MIN.	Q	WEIGHT g
RH5	28.5 ± 1.5	12.5	11.3	16.3	6.8 ± 1.5	8.5	6.2	16.4	2.4	8.9	4.3	1.6	2.1	25.3 ± 1.5	4
RH10	35.5 ± 1.5	15.9	14	19	7.9 ± 1.5	11	7.9	20.6	2.4	11	5.6	2	2.1	30.6 ± 1.5	6.4
RH25	49 ± 1.3	19.8	18.3	28	11.1 ± 1.5	14	9.9	27.5	3.2	15	8	2.4	2.1	44.6 ± 1.3	16.1
RH50	70.2 ± 1.4	21.4	39.7	50	11 ± 1.2	15.5	10.7	29.4	3.2	15	8	2.4	2.1	66.5 ± 1.4	28.6

ELECTRICAL SPECIFICATIONS

VISHAY SFERNICE MODEL AND STYLE			RH5	RH10	RH25	RH50
NF C 83-210 (CECC 40 203)			RE4	RE1	RE2	RE3
POWER RATING Chassis Mounted Resistors	MIL Limits	25 °C	5 W	10 W	20 W	30 W
		70 °C	4 W	8 W	16 W	24 W
413 cm² for RH5 and RH10 536 cm² for RH25 and RH50	Vishay Sfernice Limits	25 °C	10 W	12.5 W	25 W	50 W
		70 °C	8 W	10 W	20 W	40 W
Unmounted Resistors	Vishay Sfernice Limits	25 °C	4 W	6 W	9W	12 W
		70 °C	3.2 W	4.8 W	7.2 W	9.6 W
Rated Maximum Voltage (V_{RMS})			160 V	250 V	550 V	1285 V

ELECTRICAL SPECIFICATIONS

VISHAY SFERNICE MODEL AND STYLE			RH5	RH10	RH25	RH50
Dielectric Strength V_{RMS}			1000 V	1500 V	2500 V	2500 V
		Vishay Sfernice	0.01 Ω 12 kΩ	0.006 Ω 20 kΩ	0.006 Ω 62 kΩ	0.006 Ω 130 kΩ
		NF C 83-210	0.1 Ω 2.7 kΩ	0.1 Ω 4.99 kΩ	0.1 Ω 11.8 kΩ	0.1 Ω 33.2 kΩ
Minimum Ohmic Values in Relation to Tolerance	E 96	± 0.1 %	1 Ω		1 Ω	
	E 96	± 0.5 %	0.1 Ω		0.1 Ω	
	E 96	± 1 %	0.1 Ω		0.05 Ω	
	E 48	± 2 %	0.01 Ω		0.01 Ω	
	E 24	± 5 %	0.01 Ω		0.01 Ω	
	E 12	± 10 %	0.01 Ω	0.008 Ω	0.006 Ω	

Note

• Undergoes European Quality Insurance System (CECC)

PERFORMANCE

MIL-R-18546 D / NF C 83-210					TYPICAL DRIFTS
TESTS	CONDITIONS			REQUIREMENTS	
Operating Temperature Range	- 55 °C + 200 °C			-	-
Momentary Overload	5 P_r/5 s			± (0.25 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Climatic Sequence	- 55 °C + 200 °C 5 cycles			± (0.25 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
Load Life Test at High Temperature	2 h at + 275 °C			± (1 % + 0.05 Ω) Ins. resistance ≥ 1 GΩ	± (0.1 % + 0.05 Ω)
Humidity (Steady State)	56 days			± (1 % + 0.05) Ins. resistance ≥ 100 MΩ	± (0.5 % + 0.05 Ω)
Resistance to Moisture	Climatic sequences test, with load and polarisation			± (1 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)
Temperature Coefficient	5 to 10 > 10			± 50 ppm/°C ± 25 ppm/°C	± 15 ppm/°C
Load Life at Maximum Temperature	1000 h 25 °C	P_n MIL	Vishay	± (1 % + 0.05 Ω)	± (0.1 % + 0.05 Ω)
	200 °C	30 % of Pn	Sfernice	Ins. resistance ≥ 1 GΩ	± (0.5 % + 0.05 Ω)

MOMENTARY OVERLOAD

1. Momentary overload (> 2 s):

See example in table below. In all cases, it should be understood that:

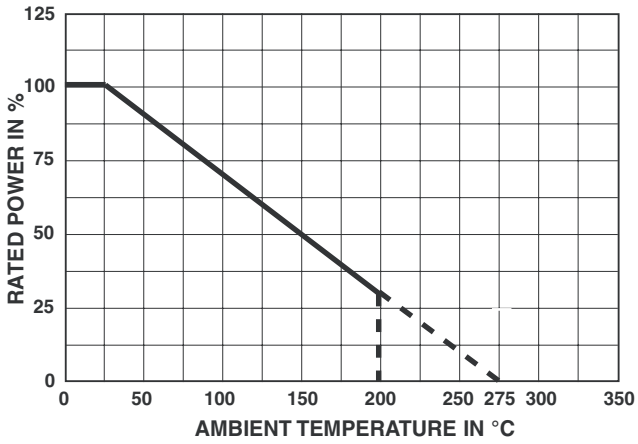
- The 12 P_n overload applies only to ohmic values 0.1.
- The overload voltage shall not be higher than that used for the dielectric strength test (see Standard Electrical Specifications).

2. Short time overload (< 2 s):

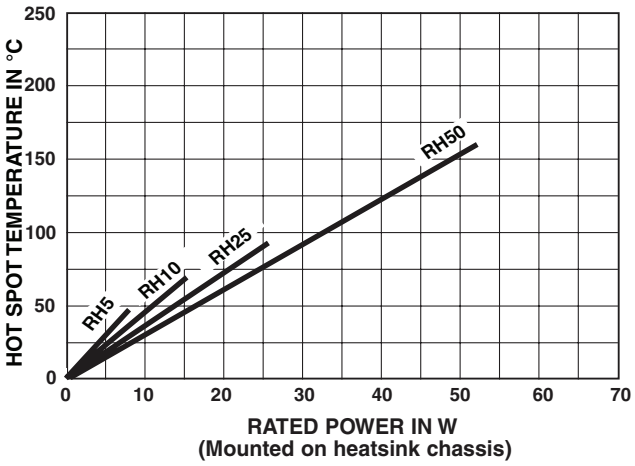
For times shorter than 2 s, higher overloads can be sustained in some cases. Consult Vishay Sfernice.

POWER LOADING	DURATION
2.5 P_n	10 s
5 P_n	5 s
12 P_n	2 s

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, CECC style (if applicable) nominal resistance (in Ω), tolerance (in %), manufacturing date.

PACKAGING

Bag of 10 units

ORDERING INFORMATION

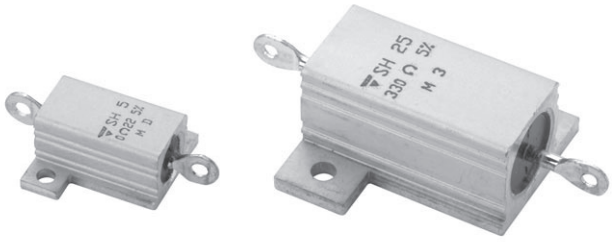
RH	05	N	18R00	J	S03
MODEL	STYLE	NON INDUCTIVE WINDING Optional	OHMIC VALUE	TOLERANCE	PACKAGING

GLOBAL PART NUMBER INFORMATION

R	H	5	0	3	3	0	0	1	J	S	0	3

GLOBAL MODEL	SIZE	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RH	**05** **10** **25** **50**	**N** = Non inductive winding	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **33001** = 33 kΩ **680R0** = 680 Ω **20301** = 20.3 kΩ **88R88** = 88.88 Ω ...	**D** = 0.5 % **F** = 1 % **G** = 2 % **J** = 5 %	**Standard Packaging:** S03 = Bag, 10 pieces	As applicable **Ex** = HDX

Heatsink Encased Wirewound Power Resistors Industrial Applications



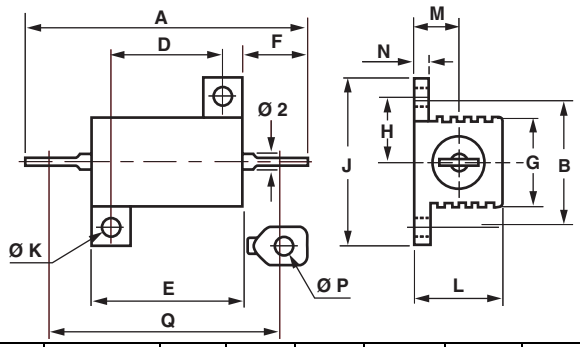
FEATURES

- ≤ 50 W at + 25 °C
- High power characteristics
- Utilize heatsink capability
- Good mechanical protection
- Industrialized product
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

Built for high power dissipation applications, these components have very good overall characteristics for industrial use under harsh environmental conditions.

DIMENSIONS in millimeters



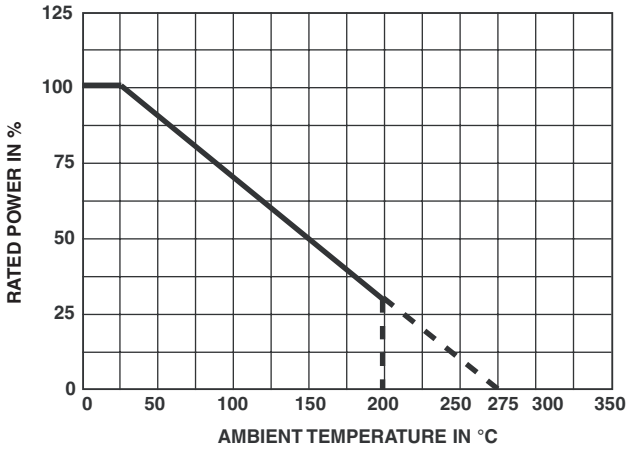
SERIES	A	B ± 0.2	D ± 0.2	E ± 0.5	F	G ± 1	H ± 0.7	J ± 0.5	Ø K ± 0.1	L MAX.	M ± 0.5	N ± 0.3	Ø P MIN.	Q	WEIGHT g
SH5	28.5 ± 1.5	12.5	11.3	16.3	6.8 ± 1.5	8.5	6.2	16.4	2.4	8.9	4.3	1.6	2.1	25.3 ± 1.5	3
SH10	35.5 ± 1.5	15.9	14	19	7.9 ± 1.5	11	7.9	20.6	2.4	11	5.6	2	2.1	30.6 ± 1.5	8.8
SH25	49 ± 1.3	19.8	18.3	28	11.1 ± 1.5	14	9.9	27.5	3.2	15	8	2.4	2.1	44.6 ± 1.3	16.5
SH50	70.2 ± 1.4	21.4	39.7	50	11 ± 1.2	15.5	10.7	29.4	3.2	15	8	2.4	2.1	66.5 ± 1.4	30.8

ELECTRICAL SPECIFICATIONS

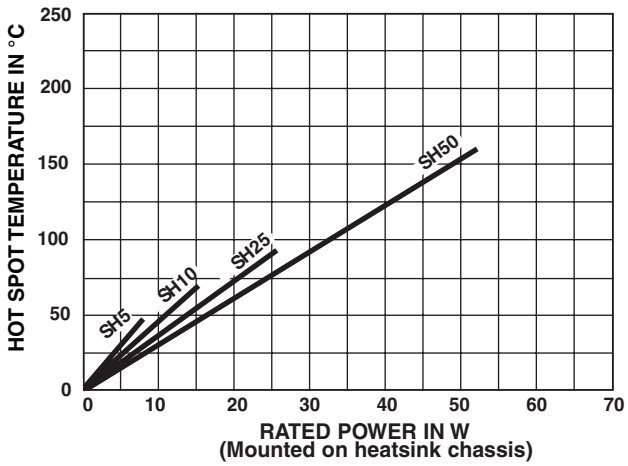
VISHAY SFERNICE SERIES		SH5	SH10	SH25	SH50
Power Rating Chassis mounted resistors: 413 cm² for SH5 and SH10, 536 cm² for SH25 and SH50	at 25 °C	10 W	12.5 W	25 W	50 W
	at 70 °C	8 W	10 W	20 W	40 W
Unmounted resistors	at 25 °C	4 W	6 W	9 W	12 W
	at 70 °C	3.2 W	4.8 W	7.2 W	9.6 W
Ohmic Value		0.1 Ω to 3.3 kΩ	0.1 Ω to 15 kΩ	0.1 Ω to 33 kΩ	0.1 Ω to 51 kΩ
Tolerance		± 5 %			
Rated Maximum Voltage		160 V	250 V	550 V	1285 V
Dielectric Strength V_{RMS}		800 V	1000 V	2000 V	2000 V
Insulation Resistance		> 10^4 MΩ		> 3 x 10^4 MΩ	
Temperature Coefficient		± 50 ppm/°C	R_n > 50 Ω		
Climatic Category		55/200/56			
Temperature Limits		- 55 °C	+ 200 °C		

PERFORMANCE		
TESTS	**CONDITIONS**	**TYPICAL DRIFTS**
Momentary Overload	5 P_n/5 s	± 0.5 % max. + 0.05 Ω
Climatic Sequence	- 55 °C + 200 °C 5 cycles	± 1 % max. + 0.05 Ω
Load Life	Nominal power P_n 1000 h at 25 °C	± 1 % max. + 0.05 Ω

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, nominal resistance (in Ω), tolerance (in %), manufacturing date.

PACKAGING
Bag of 10 units

ORDERING INFORMATION					
SH	**25**	**10 kΩ**	**5 %**	**BA10**	**e1**
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE

SAP PART NUMBERING GUIDELINES				
SH	**25**	**10001**	**J**	**S03**
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING

Fixed Wirewound High Power Vitreous Resistors with Terminal Collars or Bands

FEATURES

- 10 W to 80 W at 25 °C
- NF C 93-214
- RB 13 x 70 RB 20 x 117
- High power up to 80 W at 25 °C
- High long term stability drift < 2.5 % after 5000 h
- Great mechanical strength
- Fire proof
- Environmental performance
- Thermal shock strength 0.5 % (100 % h at - 25 °C)
- Compliant to RoHS directive 2002/95/EC

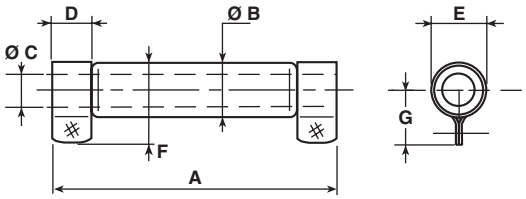
RoHS COMPLIANT

The RW wirewound power resistors are extremely well suited to professional applications, where high power and excellent endurance are required. They meet all requirements of NF C 93-214 specifications and five sizes cover the power range from 10 W to 80 W. Non inductive types are available, by using the special RWNI winding. For higher power or extremely severe conditions of use, see the RWST series.

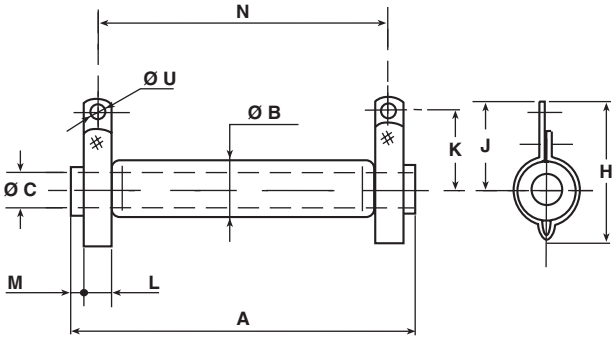
NF F 16101, 10/1988 and 16102, 04/1992: Not applicable (our parts are made of metallic and refractory materials).
NF C 93-214. Performances according to NF C 93-214.

DIMENSIONS in millimeters

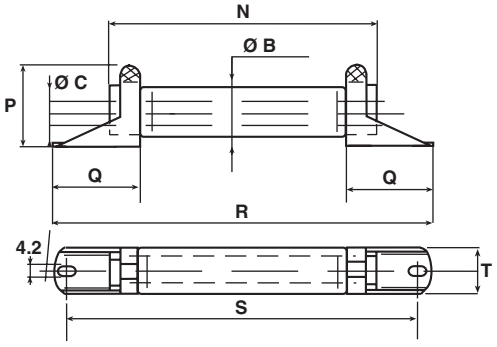
WELDED STAINLESS STEEL 304 L BAND "B"



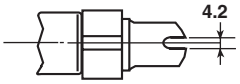
WELDED STAINLESS STEEL 304 L COLLARS "AN"



WELDED STAINLESS STEEL 304 L COLLARS "CR"



WELDED STAINLESS STEEL 304L COLLARS "CS"



SERIES	CONNECTIONS				A ± 2	Ø B MAX.	Ø C MIN.	D + 0.5 + 0	E	F MAX.	G	H	J	K
	Collar	Collar	Collar	Band										
RW 8 x 34	AN	-	-	-	34	11.5	4.1	-	-	-	-	28 ± 1.0	19.5 ± 0.5	16 ± 0.5
RW 10 x 50	AN	CR	-	B	50	13	5	8	11 ± 0.5	21	14 ± 0.5	31 ± 1.0	22 ± 0.5	18 ± 0.5
RW 13 x 70	AN	CR	CS	B	70	16	5	10.5	14 ± 0.5	24.5	16 ± 0.5	34 ± 1.0	24 ± 0.5	20 ± 0.5
RW 16 x 94	AN	-	-	B	94	19.5	9	12	17 ± 0.5	28	18 ± 0.5	38 ± 1.0	25 ± 0.5	21 ± 0.5
RW 20 x 117	AN	-	-	B	117	23	9	14	21 ± 0.7	33	21 ± 0.7	42 ± 1.5	28 ± 0.7	24 ± 0.7

Fixed Wirewound High Power Vitreous Resistors with Terminal Collars or Bands

DIMENSIONS in millimeters

SERIES	CONNECTIONS				L + 0.5 + 0	M ± 1.5	N ± 2	P ± 1	Q ± 0.5	R ± 2	S ± 2	T	Ø U
	Collar	Collar	Collar	Band									
RW 8 x 34	AN	-	-	-	5	1	27	-	-	-	-	-	3.2
RW 10 x 50	AN	CR	-	B	6.35	1.5	40	19.5	19..5	72	62	12	4.2
RW 13 x 70	AN	CR	CS	B	0.6	3.5	56	22.5	20.5	91	81	15	4.2
RW 16 x 94	AN	-	-	B	0.6	4	78	-	-	-	-	-	4.2
RW 20 x 117	AN	-	-	B	0.8	6	98	-	-	-	-	-	4.2

MECHANICAL SPECIFICATIONS

Mechanical Protection	Enamel
Resistive Element	Ni-Cr wire
Connections	B band AN - CR - CS collars
Average Unit Weight	10 g to 100 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits	- 55 °C + 450 °C
Climatic Category	- 55 °C/+ 200 °C/56 days

ELECTRICAL SPECIFICATIONS

Resistance Range	1 Ω to 68 kΩ (E12 peferred series value)
Resistance Tolerances **Standard**	± 5 %
Power Rating	10 W to 80 W at 25 °C
Temperature Coefficient	75 ppm/°C (typical)
Dielectric Strength	1000 V_{RMS} (AN collars)
Insulation Resistance	100 MΩ (500 V_{DC}) AN collars
Shelf Life	0.1 % year (typical)

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS	TYPICAL VALUES AND DRIFTS
Short Time Overload	10 P_r during 5 s Voltage limited at < 5000 V current limited at 5 A	2 % or 0.05 Ω	0.5 %
Climatic Sequence	- 55 °C + 200 °C 5 cycles	3 % or 0.05 Ω Insulation resistance > 100 MΩ	0.5 %
Humidity (Steady State)	56 days 95 % relative humidity	2 % or 0.05 Ω Insulation resistance > 100 MΩ	0.5 %
Thermal Shock	Load at 100 % P_r followed by cold temp. exposure at - 55 °C	2 % or 0.05 Ω	0.5 %
Shock	Severity 50 9 shocks/each side	1 % or 0.05 Ω	0.25 %
Vibration	Severity 55B	1 % or 0.05 Ω	0.25 %
Terminal Strength	Collar AN Traction 40 N Band B Torque 60 Ncm	1 % or 0.05 Ω	0.5 %
Load Life	90'/30' cycle 1000 h at P_r 25 °C	5 %	1000 h 1.5 % 5000 h 2.5 %

SPECIAL FEATURES

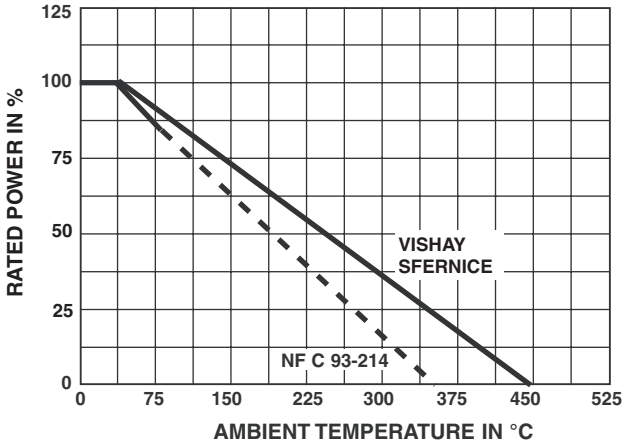
RW STYLE	8 x 34	10 x 50	13 x 70	16 x 94	20 x 117
Designation NF C 93-214	-	-	RB 13 x 70	-	RB 20 x 117
Power Rating at 25 °C	10 W	17 W	28 W	44 W	72 W
Maximum Power Rating at 25 °C	13 W	20 W	32 W	50 W	80 W
Ohmic Range (E12, E24 series)	1 Ω 10 kΩ	1 Ω 27 kΩ	2.2 Ω 56 kΩ	2.2 Ω 56 kΩ	2.7 Ω 68 kΩ
Limiting Element Voltage	300 V	450 V	650 V	900 V	1100 V
Critical Resistance	6.9 kΩ	10 kΩ	13.2 kΩ	16 kΩ	15.1 kΩ

NON INDUCTIVE WINDING

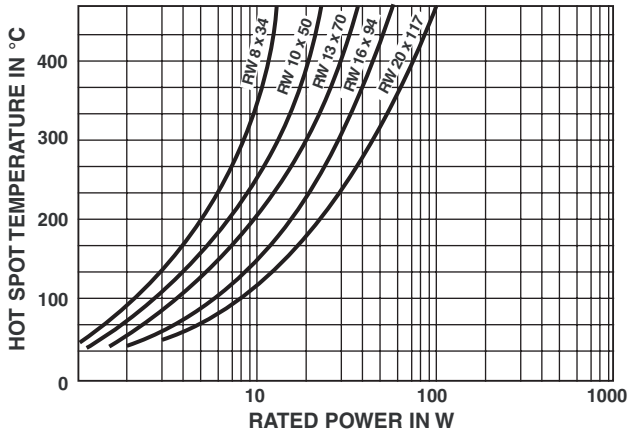
For high frequencies, low self induction resistors are available with special windings.
RWNI designation.

MODEL AND STYLE	RWNI 8 x 34	RWNI 10 x 50	RWNI 13 x 70	RWNI 16 x 94	RWNI 20 x 117
Ohmic Range	4.7 Ω 100 Ω	4.7 Ω 220 Ω	4.7 Ω 620 Ω	10 Ω 1.2 kΩ	10 Ω 2.2 kΩ

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, NF style (if applicable) nominal resistance (in Ω), tolerance (in %), manufacturing date.

ORDERING INFORMATION

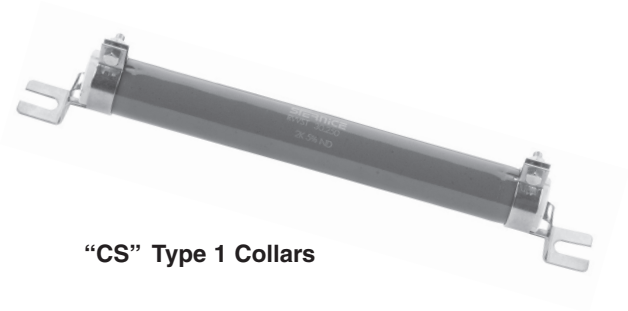
RW	20 x 117	NI		AN	68 Ω	± 5 %	B020	e
MODEL	STYLE	NON-INDUCTIVE WINDING Optional	SPECIAL DESIGN Optional	CONNECTIONS	OHMIC VALUE Custom items are subject to extra-charge and min. order. Please see price list.	TOLERANCE	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

R	W	1	6	X	9	4	A		2	0	3	J	B	0	0			

GLOBAL MODEL	SIZE	LEADS	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RW	**8 x 34** **10 x 50** **13 x 70** **16 x 94** **20 x 117**	**A** = AN **B** = B **C** = CS **D** = CR	**N** = Non inductive winding	The first two digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **203** = 20 kΩ **471** = 470 Ω **48R** = 48.7 Ω **R01** = 0.01 Ω	**J** = 5.0 %	**Box:** BA25 BA25NA BO20 BO20NA BO30 BO30NA BO40 BO40NA BO50 BO50NA	As applicable. Example: **BC1**

Fixed Wirewound High Power Vitreous Resistors
Electrical Traction Model



"CS" Type 1 Collars

FEATURES

- 95 W to 800 W at 25 °C
- NF C 93-214
- RB 25 x 168, RB 30 x 250
- Rugged construction for use in severe environmental conditions
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

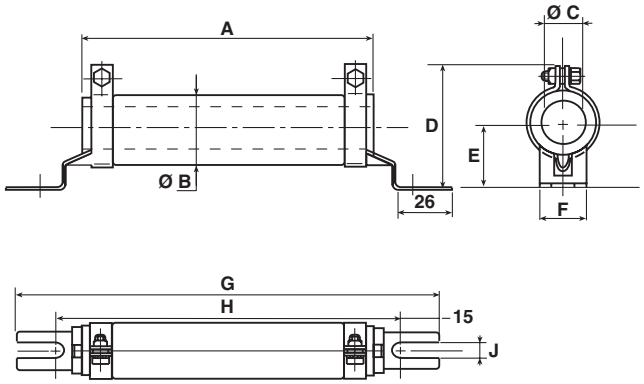
The RWST vitreous wirewound high power resistors are known for their excellent reliability which has developed out of the Vishay Sfernice experience over several decades in the field of high current applications.

Extremely severe conditions of use are encountered in electrical traction including repeated overloads. To withstand such conditions the new RWST model is extremely rugged and is manufactured to a very carefully monitored process using the best materials.

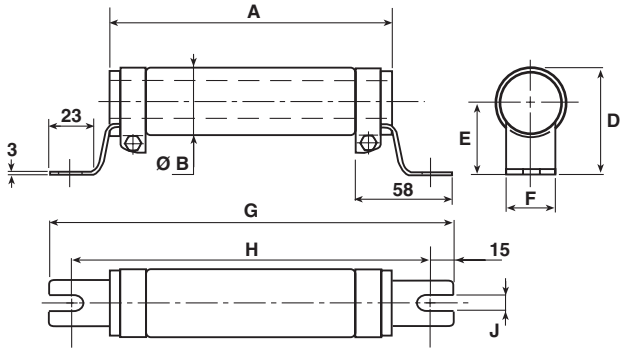
NF F 16101, 10/1988 and 16102, 04/1992: Not applicable (our parts are made of metallic and refractory materials).
NF C 93-214. Performances according to NF C 93-214.

DIMENSIONS in millimeters

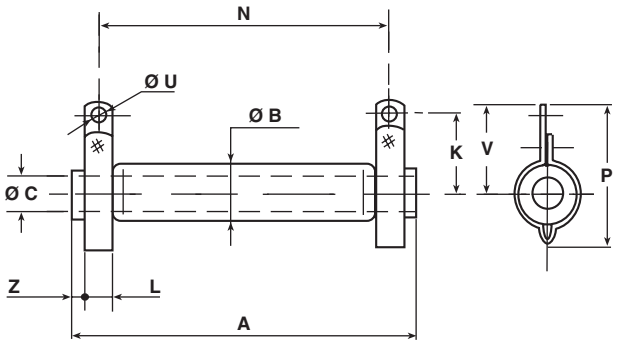
STAINLESS STEEL 304 L COLLARS "CS" TYPE 1



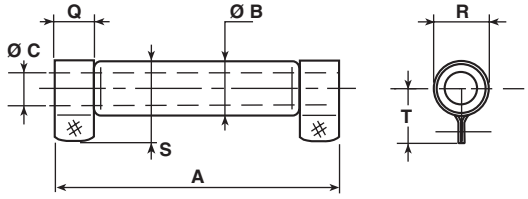
STAINLESS STEEL 304 L COLLARS "CS" TYPE 2



WELDED STAINLESS STEEL 304 L COLLARS "AN"



WELDED STAINLESS STEEL 304 L BAND "B"



For technical questions, contact: sfer@vishay.com

Fixed Wirewound High Power Vitreous Resistors
Electrical Traction Model

DIMENSIONS in millimeters

SERIES	CONNECTIONS	A ± 2	Ø B MAX.	Ø C MIN.	D	E	F ± 0.5	G - 4/+ 0	H - 4/+ 0	J ± 0.5	K	L + 0.5 + 0
RWST 25 x 138	AN-B CS type 1	138	28	12	50 ± 1.5	27 ± 1	24	199	169	6.5	28.5 ± 1	9
RWST 25 x 168	AN-B CS type 1	168	28	12	50 ± 1.5	27 ± 1	24	229	199	6.5	28.5 ± 1	9
RWST 30 x 250	AN-B CS type 1	250	33	17	60 ± 1.5	30 ± 1	25	317	287	9	31± 1	13
RWST 40 x 370	AN CS type 2	370	45	22	69 max.	45 ± 1.5	30	432	405	9	45 ± 1.5	18
RWST 50 x 373	AN CS type 2	373	53	27.1	80 max.	51 ± 1.5	30	432	405	9	51 ± 1.5	18

SERIES	CONNECTIONS	N ± 2	P	Q - 0/+ 5	R - 0.3/+ 0.9	S MAX.	T ± 1	Ø U	V	Z	AVERAGE UNIT WEIGHT IN g (CS collars)
RWST 25 x 138	AN-B CS type 1	117 ± 2	51.5 ± 1.5	15	26	38.5	23.5	5.7	33.5 ± 1	6	225
RWST 25 x 168	AN-B CS type 1	147 ± 2	50 ± 1.5	15	26	38.5	23.5	5.7	33.5 ± 1	6	250
RWST 30 x 250	AN-B CS type 1	227 ± 2	55 ± 1.5	18	31	43.5	26	5.7	36 ± 1	5	445
RWST 40 x 370	AN CS type 2	332 ± 3	81.5 max.	-	-	-	-	9.2	57 ± 1.5	10	1400
RWST 50 x 373	AN CS type 2	332 ± 3	92.5 max.	-	-	-	-	9.2	63 ± 1.5	11.5	2200

MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous enamel
Resistive Element	Ni-Cr wire
Connections	CS supporting collars
AN Collar or B	on request
Average Unit Weight	225 g to 2200 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits	- 55 °C + 450 °C
Climatic Category	- 55 °C/+ 200 °C/56 days

ELECTRICAL SPECIFICATIONS

Resistance Range	2.7 Ω to 430 kΩ (E12, E24 preferred series values)
Resistance Tolerance Standard	± 5 %
Power Rating	95 W to 800 W at 25 °C
Temperature Coefficient	75 ppm/°C (typical)
Shelf Life	0.1 % year (typical)

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS	TYPICAL VALUES AND DRIFTS
Short Time Overload	10 P_r during 5 s Voltage limited at < 5000 V	2 % or 0.05 Ω	0.5 %
Climatic Sequence	- 55 °C + 200 °C	2 % or 0.05 Ω Insulation resistance 100 MΩ	0.5 %
Humidity (Steady State)	56 days 95 % relative humidity	3 % or 0.05 Ω Insulation resistance 100 MΩ	0.5 %
Thermal Shock	Load at 100 % P_r followed by cold temperature exposure at - 55 °C/15'	2 % or 0.05 Ω	0.5 %
Shock	Severity 50 A 9 shocks/each side	1 % or 0.05 Ω	0.25 %
Vibration	Severity 55B	1 % or 0.05 Ω	0.25 %
Terminal Strength AN B	Traction 40 Ncm Torque 60 Ncm	1 % or 0.05 Ω	0.5 %
Load Life	90'/30' cycle 1000 h at P_r 25 °C	5 %	1000 h 1 % 5000 h 2 %

SPECIAL FEATURES

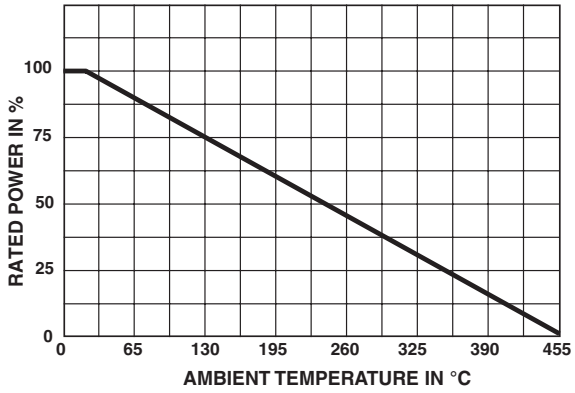
RWST STYLE	25 x 138	25 x 168	30 x 250	40 x 370	50 x 373
Designation NF C 93-214	-	RB 25 x 168	RB 30 x 250	-	-
Power Rating at 25 °C	95 W	160 W	280 W	500 W	700 W
Maximum Power Rating at 25 °C	110 W	180 W	320 W	600 W	800 W
Ohmic Range (E12, E24 series)	2.7 Ω 82 kΩ	2.7 Ω 100 kΩ	4.7 Ω 220 kΩ	8.2 Ω 360 kΩ	12 Ω 430 kΩ
Limiting Element Voltage	1400 V	1900 V	3000 V	4500 V	5000 V
Critical Resistance	18 kΩ	20 kΩ	30 kΩ	36 kΩ	30 kΩ

NON INDUCTIVE WINDING

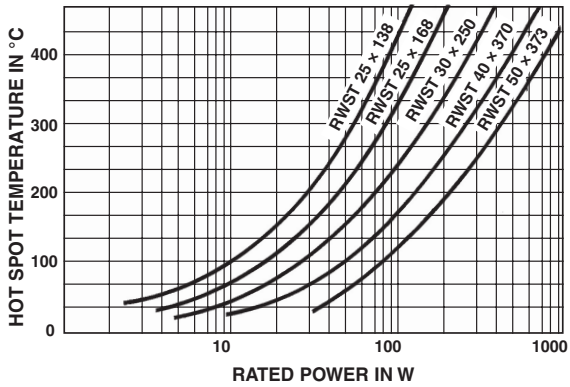
For high frequencies, low self induction resistors are available with special windings. RWSTNI designation.

MODEL AND STYLE	RWSTNI 25 x 138	RWSTNI 25 x 168	RWSTNI 30 x 250	RWSTNI 40 x 370	RWSTNI 50 x 373
OHMIC RANGE (E12 SERIES)	22 Ω 2.5 kΩ	22 Ω 4 kΩ	120 Ω 6.8 kΩ	120 Ω 8.2 kΩ	150 Ω 8.2 kΩ

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, nominal resistance (in Ω), tolerance (in %), manufacturing date.

PACKAGING

Box: Fixed quantity depending on size and connections

ORDERING INFORMATION

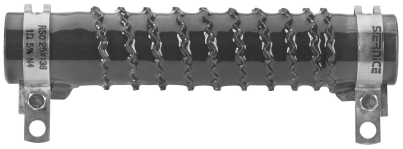
RWST	25 x 138			B	56U	± 5 %	B06	e
MODEL	STYLE	NON-INDUCTIVE WINDING	SPECIAL DESIGN	CONNECTIONS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
		Optional	Optional		Custom items are subject to extra-charge and min. order. Please see price list.			

GLOBAL PART NUMBER INFORMATION

R	W	S	T	2	5	1	6	8	C		4	7	0	0	J	B	0	4			

GLOBAL MODEL	SIZE	LEADS	OPTION	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RWST	**25 x 138** **25 x 168** **30 x 250** **40 x 370** **50 x 373**	**A** = AN **B** = B **C** = CS **F** = Faston	**N** = Non inductive winding	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **4700** = 470 Ω **48R8** = 48.7 Ω **R010** = 0.01 Ω **R470** = 0.47 Ω	**J** = 5.0 % **K** = 10 %	**Box:** BO1 BO2 BO2NA BO4 BO4NA BO6 BO6NA	As applicable. Example: **BA7**

Fixed Wirewound Enamelled Corrugated Tape Resistors Very High Dissipation



AN Collars

CS Collars

FEATURES

- 160 W to 1 kW at 25 °C
- Compliant to RoHS directive 2002/95/EC

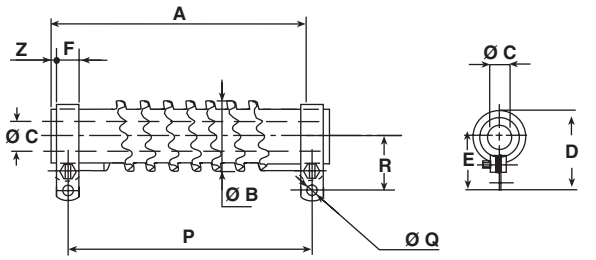
RoHS COMPLIANT

The remarkable dissipation power of this series is the result of an original winding method using corrugated edge-wound tape, thus forming a very active radiator. The enamelling follows the contour of the resistive element and provides effective insulation and support for the winding.
The tubular core is of special ceramic, capable of withstanding high thermal shock and overload of short duration.

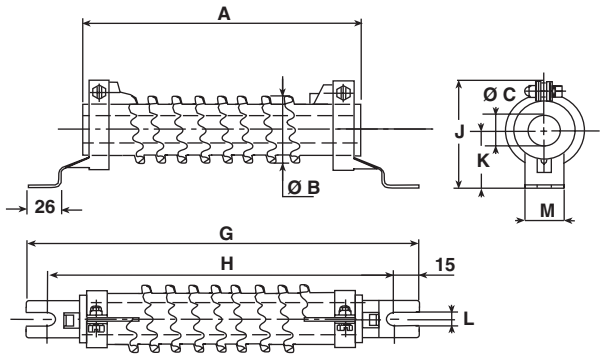
NF F 16101, 10/1988 and 16102, 04/1992: Not applicable (our parts are made of metallic and refractory materials).

DIMENSIONS in millimeters

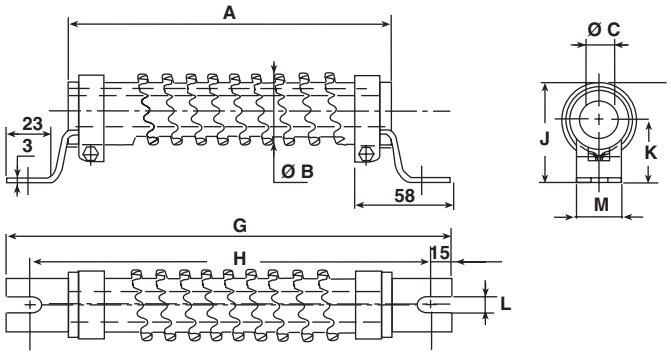
SCREWED STAINLESS STEEL 304 I "AN" TYPE 1



SCREWED STAINLESS STEEL 304 I "CS" TYPE 1



SCREWED STAINLESS STEEL 304 I "CS" TYPE 2



DIMENSIONS in millimeters

RSO SERIES	CONNECTIONS		A ± 2	Ø B MAX.	Ø C MIN.	D MAX.	E	F + 0.5 + 0	G - 4/+ 0	H - 4/+ 0	J
25 x 138	AN type 1	CS type 1	138	39	12.6	54	33.5 ± 1	9	199	169	50 ± 1.5
25 x 168	AN type 1	CS type 1	168	39	12.6	54	33.5 ± 1	9	229	199	50 ± 1.5
30 x 250	AN type 1	CS type 1	250	44	17.4	62	36 ± 1	13	317	287	60 ± 1.5
40 x 370	AN type 2	CS type 2	370	54.5	22.3	85.5	57 ± 1.5	18	432	405	73.8
50 x 373	AN type 2	CS type 2	373	65	27.1	97	63 ± 1.5	18	432	405	79

RSO SERIES	CONNECTIONS		K	L + 0.5	M ± 0.5	P	Q	R	Z	AVERAGE UNIT WEIGHT IN g	
										AN	CS
25 x 138	AN type 1	CS type 1	27 ± 1	6.5	24	117 ± 2	5.7	28.5 ± 1	6	160	205
25 x 168	AN type 1	CS type 1	27 ± 1	6.5	24	147 ± 2	5.7	28.5 ± 1	6	190	235
30 x 250	AN type 1	CS type 1	30 ± 1	9	25	227 ± 2.5	5.7	31 ± 1	5	350	400
40 x 370	AN type 2	CS type 2	45 ± 1.5	9	30	332 ± 3	9.2	45 ± 1.5	10	960	1040
50 x 373	AN type 2	CS type 2	45 ± 1.5	9	30	332 ± 3	9.2	51 ± 1.5	11.5	1375	1455

MECHANICAL SPECIFICATIONS

Mechanical Protection	Enamel
Resistive Element	Ni-Cr wire
Connections	AN CS supporting collars
Average Unit Weight	160 to 1455 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits	- 55 °C + 450 °C
Climatic Category	- 55 °C/+ 200 °C/56 days

ELECTRICAL SPECIFICATIONS

Resistance Range	0.068 Ω to 68 Ω (E12 preferred series)
Standard Resistance Tolerance	$R_n \geq 1\ \Omega \pm 5\ \%$ $R_n < 1\ \Omega \pm 10\ \%$
Power Rating	160 W to 1 kW at 25 °C
Temperature Coefficient	180 ppm/°C (typical)

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS	TYPICAL VALUES AND DRIFTS
Short Time Overload	10 P_r during 5 s	2 % or 0.05 Ω	1 %
Thermal Shock	Load at P_r followed by cold temp. exposure at - 55 °C/15 s	2 % or 0.05 Ω	1 %
Climatic Sequence	Phase A: + 200° Phase C: - 55° Phase D: 5 cycles	3 % or 0.05 Ω	1 %
Load Life	90/30' cycle 1000 h at P_r 25 °C	5 %	2 %

SPECIAL FEATURES

RSO STYLE	25 x 138	25 x 168	30 x 250	40 x 370	50 x 373
Power Rating at 25 °C	160 W	200 W	350 W	700 W	1000 W
Resistance Ohmic Range (E12 Series)	0.068 Ω 12 Ω	0.10 Ω 18 Ω	0.22 Ω 33 Ω	0.33 Ω 56 Ω	0.39 Ω 68 Ω

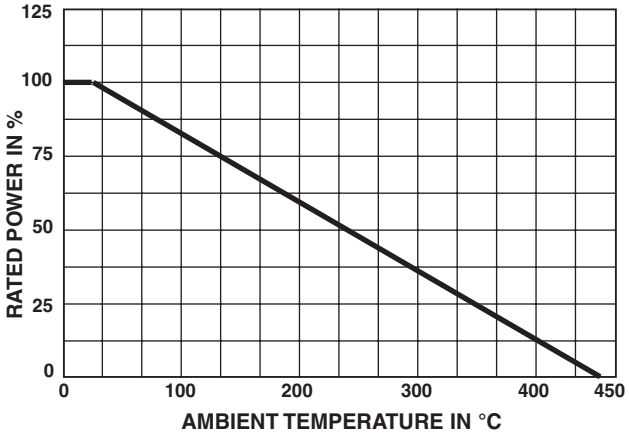
RECOMMENDATIONS FOR USE

OVERLOAD:
The RSO resistors are capable of withstanding overloads of about 10 P_r for a maximum period of 5 s; they can resist momentarily even greater overloads.

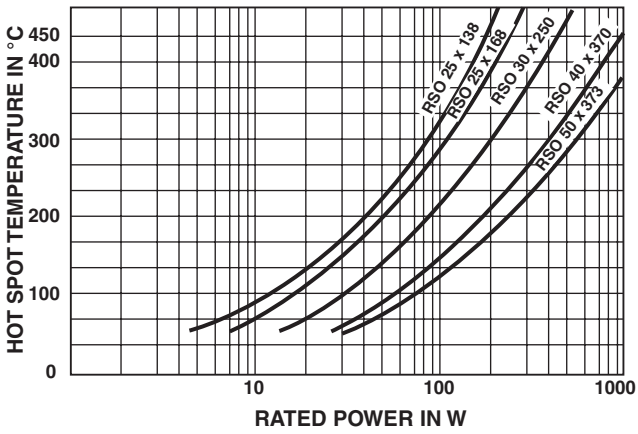
Particular requirements should be submitted to Vishay Sfernice.

Fixed Wirewound Enamelled Corrugated Tape Resistors
Very High Dissipation

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, nominal resistance (in Ω), tolerance (in %), manufacturing date.

PACKAGING

Box: Fixed quantity depending on size and collars

ORDERING INFORMATION

RSO	25 x 168	XXX	CS	U82	± 10 %	B02NA	e
MODEL	STYLE	SPECIAL DESIGN	CONNECTIONS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
		Method N° Optional		Custom items are subject to extra-charge and min. order. Please see price list.			

SAP PART NUMBERING GUIDELINES

RSO	25168	C	R820	K	N
MODEL	STYLE	CONNECTIONS	OHMIC VALUE	TOLERANCE	PACKAGING

Adjustable Wirewound Enamelled Resistors

"B" Ring

FEATURES

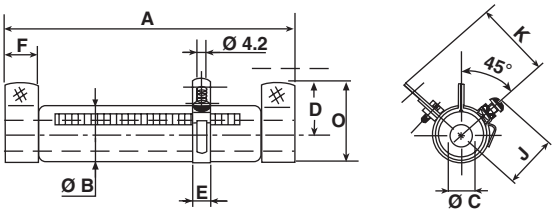
- 21 W to 180 W at 25 °C
- NF C 93-214
  - RBA 13 x 70
  - RBA 20 x 117
  - RBA 25 x 168
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

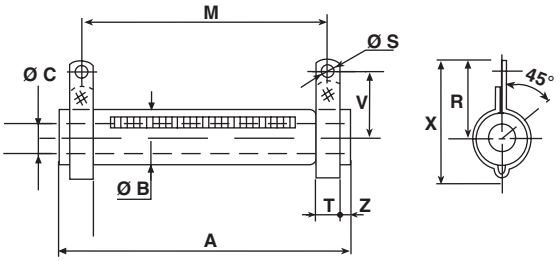
The ceramic tubular core ensures high dissipation capacity and excellent resistance to thermal shock and overload. The resistor winding is evenly coiled on the core and protected by an enamel coating. A longitudinal opening provides for one or more electrical connections by means of sliding collars equipped with a tongued connector.

DIMENSIONS in millimeters

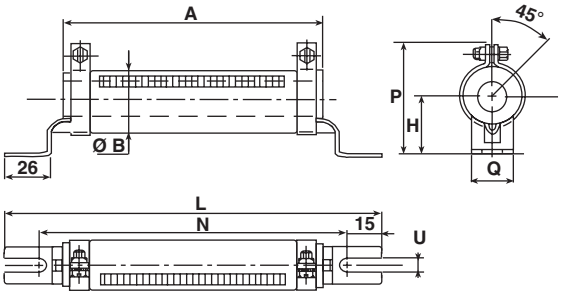
WELDED STAINLESS STEEL 304 L BAND "B"



WELDED STAINLESS STEEL 304 L COLLAR "AN" TYPE 1



SCREWED STAINLESS STEEL 304 L "CS" TYPE 1



RA SERIES	CONNECTION	A ± 2	Ø B MAX.	Ø C MIN.	D	E + 0.5 + 0	F + 0.5 + 0	H ± 1	J MAX.	K MAX.	L - 0 - 4	M	N - 0 - 4
13 x 70	AN-B (1)	70	16	5	16 ± 0.5	7	10.5	-	19.5	24	-	56 ± 2	-
16 x 94	AN-B	94	19.5	9	17.5 ± 0.5	8	12	-	23	29.5	-	78 ± 2	-
20 x 117	AN-B	117	23	9	21 ± 0.7	8	14	-	25	31.5	-	98 ± 2	-
25 x 138	AN-B-CS	138	28	12	23.5 ± 1	8	15	27	27.5	34	199	117 ± 2	169
25 x 168	AN-B-CS	168	28	12	23.5 ± 1	8	15	27	27.5	34	229	147 ± 2	199
30 x 250	AN-B-CS	250	33	17	26 ± 1	8	18	30	30	36.5	317	227 ± 2.5	287

RA SERIES	CONNECTION	O MAX.	P ± 1.5	Q ± 0.5	R	S	T	U	V	X	Z	AVERAGE UNIT WEIGHT IN g
13 x 70	AN-B (1)	24.5	-	-	24 ± 0.5	4.2	6.35	-	20 ± 0.5	34.5 ± 1	3.5	40
16 x 94	AN-B	28	-	-	26.5 ± 0.5	4.2	6.35	-	21 ± 0.5	38 ± 1	5	70
20 x 117	AN-B	33	-	-	31 ± 0.7	4.2	6.35	-	24 ± 0.7	42 ± 1	6	116
25 x 138	AN-B-CS	38.5	50	24	33.5 ± 1	5.7	9	6.5	28 ± 1	51 ± 1.5	6	200
25 x 168	AN-B-CS	38.5	50	24	33.5 ± 1	5.7	9	6.5	28 ± 1	51 ± 1.5	6	225
30 x 250	AN-B-CS	43.5	60	25	36 ± 1	5.7	13	9	33 ± 1	55 ± 1.5	5	415

Note

(1) Also with CS and CR collars; see RW datasheet

MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous enamel
Resistive Element	Ni-Cr wire
Connections	B band AN or CS collar
Average Unit Weight	40 g to 415 g

ELECTRICAL SPECIFICATIONS

Resistance Range	33 to 22K (E6 series)
Tolerance	
Standard	± 10 %
Power Rating	21 W to 180 W at 25 °C
Temperature Coefficient	+ 75 ppm/°C (typical)

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits	- 55 °C + 350 °C
Climatic Category	- 55 °C/+ 200 °C/56 days

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS	TYPICAL VALUES AND DRIFTS
Short Time Overload	10 P_r 5 s Voltage < 6000 V	2 % or 0.05	0.5 %
Climatic Sequence	- 55 °C + 200 °C 5 cycles	3 % or 0.05 Insulation resistance > 100M	1 %
Humidity (Steady State)	56 days 95 % R.H.	2 % or 0.05 Insulation resistance > 100M	0.5 %
Thermal Shock	Load at P_r followed by exposure at - 55 °C/15	2 % or 0.05	0.5 %
Resistor Strength	200 N ± 10 N	2 % or 0.05	0.25 %
Vibration	55/10	1 % [1] or 0.05	0.5 %
Terminal Strength AN B	Traction 40 Ncm Torque 60 Ncm	1 % or 0.05	0.25 %
Load Life	1000 h at P_r 25 °C 90'/30'	5 %	1.5 %

Note

[1] 1 % of total resistance and 2 % between sliding collar and fixed connection

SPECIAL FEATURES

RA STYLE	13 x 70	16 x 94	20 x 117	25 x 138	25 x 168	30 x 250
Designation NF C 93-214	RBA 13 x 70	-	RBA 20 x 117	-	RBA 25 x 168	-
Power Rating NF C 93-214 at 25 °C	13 W	-	25 W	-	50 W	-
Maximum Power Rating at 25 °C	21 W	35 W	50 W	75 W	120 W	180 W
Ohmic Range (E6, E24 series)	33 3.9K	68 3.9K	100 4.7K	150 6.8K	220 10K	330 22K

ADMISSIBLE RATED AMPERAGE

This must in all cases be less than:

$$I_n = \sqrt{\frac{P_n(W)}{R_n(\Omega)}}$$

SLIDING COLLAR

Resistors are normally supplied with 1 sliding collar fi tted and locked in a specifi c position.
Additional collars can be supplied and adjusted at the factory to special order (on request). [1]

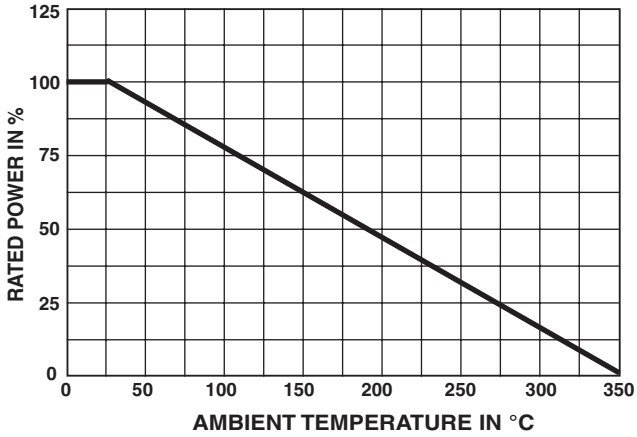
Note

[1] Quote ohmic value and tolerance of each resistance section, and R_n value.

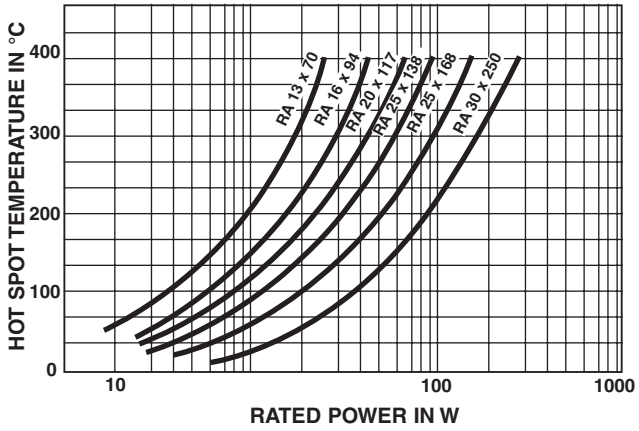
MAXIMUM ADDITIONAL COLLARS

MODEL AND TYPE	RA 13 x 70	RA 16 x 94	RA 20 x 117	RA 25 x 138	RA 25 x 168	RA 30 x 250
Additional sliding collar	1	1	1	2	3	4

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, NF style (if applicable) ohmic value (in Ω), tolerance (in %), manufacturing date.

ORDERING INFORMATION

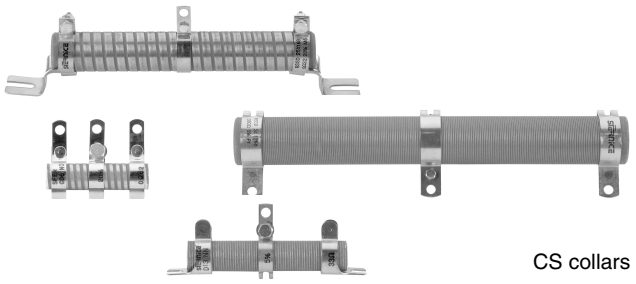
RA	13 x 70		AN	470U	± 10 %	1 C. SUP.	BO10	e
MODEL	STYLE	SPECIAL DESIGN	CONNECTIONS	OHMIC VALUE	TOLERANCE	ADDITIONAL SLIDING COLLAR	PACKAGING	LEAD (Pb)-FREE
		In option	Custom items are subject to extra-charge and min. order. Please see price list.					

GLOBAL PART NUMBER INFORMATION

R	A	3	0	2	5	0	A	6	8	0	R	0	K	B	0	3			

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RA	**13 x 70** **16 x 94** **20 x 117** **25 x 138** **25 x 168** **30 x 250**	**A** = AN **B** = B **C** = CS **D** = CR	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **680R0** = 630 Ω **20301** = 20.3 kΩ **88R88** = 88.88 Ω	**K** = 10 %	**Box:** BO10 BO10NA BO20 BO30 BO30NA BO40 BO40NA	As applicable. Example: **BA7**

Adjustable Wirewound Vitreous Resistors Low Ohmic Values (0.10 Ω available)



CS collars

FEATURES

- High power rating: 16 W to 600 W at 25 °C
- Heavy overloads 10 P_n 15 s ≤ 1 %
- Low ohmic values 0.10 Ω available
- High long term stability drift < 1.5 % after 1000 h
- Excellent withstanding of thermal shock
- Mechanical strength
- Fire proof
- Compliant to RoHS directive 2002/95/EC

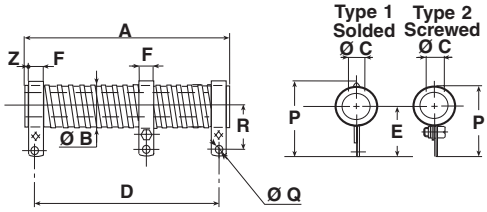
Pb-free
RoHS COMPLIANT

RSSD medium and high power resistors are noted for their ability to withstand heavy transient and severe shock and vibration conditions. They complement the ohmic range of Vishay styles RW, RWST and RA in the low value area, and can be tapped by means of adjustable collars. Standard RSSD resistors have a single adjustable collar.

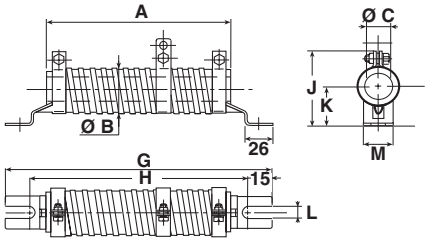
NF F 16101, 10/1988 and 16102, 04/1992: Not applicable (our parts are made of metallic and refractory materials).

DIMENSIONS in millimeters

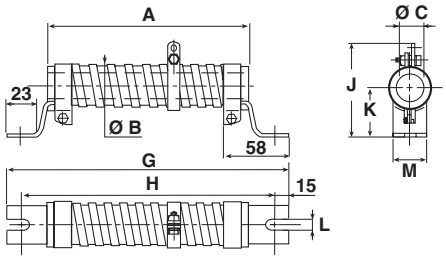
WELDED STAINLESS STEEL 304 L COLLARS "AN" TYPE 1



SCREWED STAINLESS STEEL 304 L COLLARS "CS" TYPE 1



SCREWED STAINLESS STEEL 304 L COLLARS "CS" TYPE 2



RSSD SERIES	CONNECTION	A ± 2	Ø B MAX.	Ø C MIN.	D	E	F + 0.5 + 0	P	Ø Q	R	Z APPROX.	AVERAGE UNIT WEIGHT IN g
8 x 34	AN type1	34	10	4.1	27 ± 2	20 ± 0.5	5	28 ± 1	3.2	16 ± 0.5	1	10
10 x 50	AN type1	50	11.5	5	40 ± 2	22 ± 0.5	6.35	31 ± 1	4.2	18 ± 0.5	1.5	22
13 x 70	AN type1	70	14.5	6.7	56 ± 2	24 ± 0.5	6.35	34 ± 1	4.2	20 ± 0.5	3.5	38
16 x 94	AN type1 CS (1)	94	18	9.2	78 ± 2	26.5 ± 0.5	6.35	38 ± 1	4.2	21 ± 0.5	4	55
20 x 117	AN type1	117	22	12.6	98 ± 2	31 ± 0.7	6.35	42 ± 1	4.2	24 ± 0.7	5	80

Note
(1) CS connections on request

DIMENSIONS in millimeters

RSSD SERIES	CONNECTIONS		A ± 2	Ø B MAX.	Ø C MIN.	D	E	F + 0.5 + 0	G - 4 - 0	H - 4 - 0	J
25 x 138	AN type1	CS type1	138	27	16.4	117 ± 2	33.5 ± 1	9	199	169	50 ± 1.5
25 x 168	AN type1	CS type1	168	27	16.4	147 ± 2	33.5 ± 1	9	229	199	50 ± 1.5
30 x 250	AN type1	CS type1	250	32	21.3	227 ± 2.5	36 ± 1	13	317	287	60 ± 1.5
40 x 370	AN type2	CS type2	370	43	22.3	332 ± 3	57 ± 1.5	18	432	405	69 max.
50 x 373	AN type2	CS type2	373	53	27.1	332 ± 3	63 ± 1.5	18	432	405	80 max.

RSSD

Vishay Sfernice

Adjustable Wirewound Vitreous Resistors
Low Ohmic Values (0.10 Ω available)

DIMENSIONS in millimeters

RSSD SERIES	CONNECTIONS		K	L ± 0.5	M ± 0.5	P	Ø Q	R	Z APPROX.	AVERAGE UNIT WEIGHT IN g	
										AN	CS
25 x 138	AN type1	CS type1	27 ± 1	6.5	24	51 ± 1.5	5.7	28.5 ± 1	6	90	135
25 x 168	AN type1	CS type1	27 ± 1	6.5	24	51 ± 1.5	5.7	28.5 ± 1	6	115	160
30 x 250	AN type1	CS type1	30 ± 1	9	25	55 ± 1.5	5.7	31± 1	5	240	290
40 x 370	AN type2	CS type2	45 ± 1	9	30	81.5 max.	9.2	45 ± 1.5	10	845	925
50 x 373	AN type2	CS type2	51 ± 1.5	9	30	92.5 max.	9.2	51 ± 1.5	11.5	1270	1350

MECHANICAL SPECIFICATIONS

Mechanical Protection Vishay Sfernice Special cement
Resistive Element Nickel alloy wire
Connections AN collars
CS supporting collars
Average Unit Weight 10 g to 1350 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits - 55 °C + 450 °C
Climatic Category - 55 °C/+ 200 °C/56 days

ELECTRICAL SPECIFICATIONS

Resistance Range	0.12 Ω to 560 Ω (E12 series)
Standard Resistance	$R \geq 10\ \Omega \pm 5\ \%$
Tolerance	$1\ \Omega \leq R \leq 10\ \Omega \pm 10\ \%$ $0.1\ \Omega \leq R < 1\ \Omega \pm 20\ \%$
Power Rating	14 W to 600 W at 25 °C
Temperature Coefficient	+ 75 ppm/°C (typical)

PERFORMANCE

TESTS	CONDITIONS	REQUIREMENTS	TYPICAL VALUES AND DRIFTS
Short Time Overload	10 P_r during 5 s	2 %	1 %
Climatic Sequence	- 55 °C + 200 °C 5 cycles	3 %	1 %
Thermal Shock	Load at 100 % P_r followed by cold - 55 °C/15	2 % or 0.05 Ω	1 %
Load Life	90/30 cycle 1000 h at P_r at + 25 °C	5 %	1.5 %

SPECIAL FEATURES

RSSD TYPE		8 x 34	10 x 50	13 x 70	16 x 94	20 x 117	25 x 138	25 x 168	30 x 250	40 x 370	50 x 373
Power Rating at 25 °C	**Continuous**	16 W	25 W	42 W	70 W	100 W	140 W	200 W	280 W	450 W	600 W
	Reduced	14 W	22 W	38 W	62 W	90 W	125 W	170 W	240 W	360 W	450 W
Resistance Ohmic Range (E12, E24 Series) with 1 Tapping		0.12 Ω 10 Ω	0.12 Ω 22 Ω	0.12 Ω 43 Ω	0.33 Ω 75 Ω	0.22 Ω 100 Ω	0.10 Ω 150 Ω	0.12 Ω 220 Ω	0.22 Ω 360 Ω	0.47 Ω 470 Ω	0.68 Ω 560 Ω
Maximum Number of Additional Tapping		0	1	1	1	1	1	2	2	4	4
Reduction % of Ohmic Value by Tapping		23	21	14	11	10	8	6.5	6	5.7	5.7

ADDITIONAL TAPPINGS

Are supplied with their adjustable collars fastened but not set to any specific value. Please note that, on request, all tappings can be adjusted by Vishay Sfernice. For adjustment purposes we would need to be advised of the ohmic values, and tolerances of the sections in successive order in addition to their sum R_n.

The permissible maximum value for an adjustment should take into account the possible negative tolerance of R_n.

Please consult Vishay Sfernice regarding the acceptable tolerance.

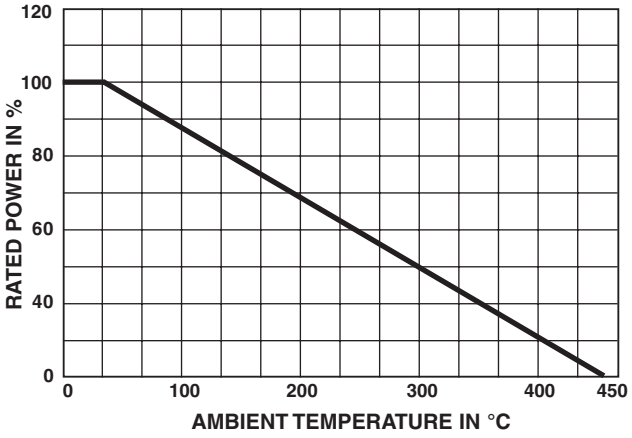
Adjustable Wirewound Vitreous Resistors
Low Ohmic Values (0.10 Ω available)

RECOMMENDATIONS FOR USE

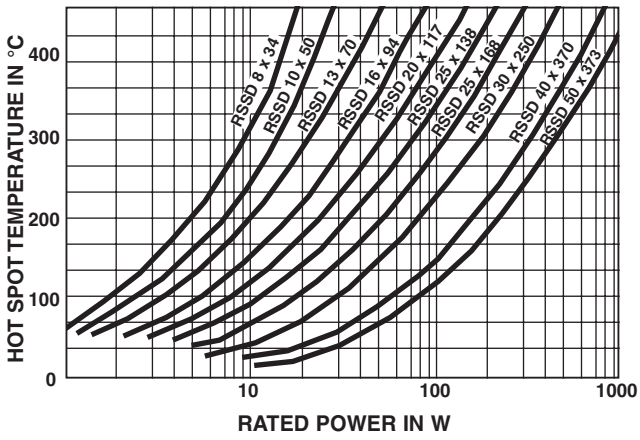
Maximum Current Strength:
The ohmic value and the power decrease as the connections are brought together. To avoid overload, the maximum current strength that is permissible for R_n should never be exceeded:

$I_{max.} = \sqrt{P_r / R_n}$

POWER RATING



TEMPERATURE RISE



MARKING

Vishay Sfernice trademark, model, style, nominal resistance (in Ω), tolerance (in %), manufacturing date.

ORDERING INFORMATION

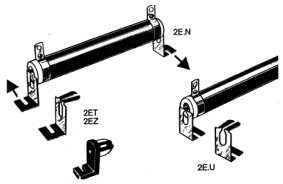
RSSD	10 × 50		AN	10U	5 %	BA25	e
MODEL	STYLE	SPECIAL DESIGN Method Nº Optional	CONNECTIONS	OHMIC VALUE Custom items are subject to extra-charge and min. order. Please see price list.	TOLERANCE	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

R	S	S	D	2	5	1	3	8	A	1	5	R	0	J	B	1	5			

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RSSD	**08 x 34** **10 x 50** **13 x 70** **16 x 94** **20 x 117** **25 x 138** **25 x 168** **30 x 250** **40 x 370** **50 x 373**	**A** = AN **B** = B **C** = CS **F** = Faston	The three first digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4710** = 470 Ω **48R5** = 48.5 Ω **R010** = 0.01 Ω ...	**J** = 5 % **K** = 10 % **M** = 20 %	Standard packaging: **BXX** = Box, XXPCS (fixed qty depending on size) No standard packaging: **B00** = Box, qty open	As applicable. Example: **CB4**

Fixing Accessories for Wirewound Resistors Equipped with AN Collars Suitable for RW - RA - RSSD - RSO



These 2E double right-angle brackets are designed to fix resistors without providing electrical contact. As they are fitted to resistors with fixing insulated connections, they can be mounted on uninsulated panels.

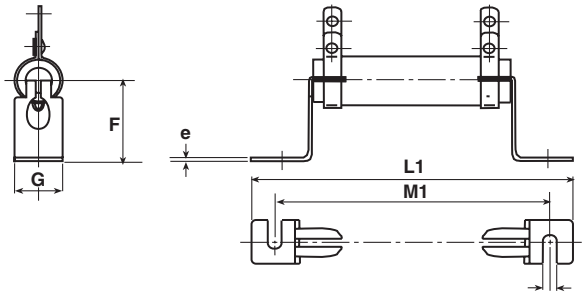
FEATURES

- They are available in three versions:
  - Bracket 2E N Shape ⌐¬
  - Bracket 2E U Shape ⊏ (restricted space)
  - Brackets 2E T or 2E Z shape ⌐¬ designed for models of Ø 40 mm and 50 mm
- The brackets are metal, and are corrosion-resistant
- Compliant to RoHS directive 2002/95/EC

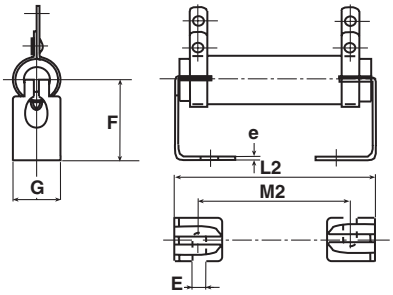
RoHS COMPLIANT

DIMENSIONS in millimeters

DOUBLE RIGHT-ANGLE BRACKET 2E N



DOUBLE RIGHT-ANGLE BRACKET 2E U



DIMENSIONS in millimeters

SERIES		BRACKET	E ± 0.1	F ± 1	G ± 0.5	L1 - 0 - 4	M1 - 1 - 4	L2 - 0 - 4	M2 - 0 - 4	E	AVERAGE UNIT WEIGHT IN g
RW RSO RA	RSSD										
8 x 34	**8 x 34**	2E BN or 2E BU	3.2	21.5	8	58	48	38	26	1	1.8
10 x 50	**10 x 50**	2E DN or 2E DU	3.2	21.5	10	74	64	54	42	1	2.2
13 x 70		2E DN or 2E DU	3.2	21.5	10	94	84	74	62	1	2.2
	13 x 70	2E FN or 2E FU	4	26.5	14	102.5	88.5	74.5	58	1.2	4.5
16 x 94	**16 x 94**	2E HN or 2E HU	5	29.5	20	132.5	115.5	98.5	79	1.2	8
20 x 117		2E HN or 2E HU	5	29.5	20	155.5	138.5	121.5	102	1.2	8
	20 x 117	2E KN or 2E KU	5.5	37.5	22	161.5	141.5	121.5	99	1.2	13
25 x 138		2E KN or 2E KU	5.5	37.5	22	182.5	162.5	142.5	120	1.2	13
25 x 168		2E KN or 2E KU	5.5	37.5	22	212.5	192.5	172.5	150	1.2	13
	25 x 138	2E MN or 2E MU	5.5	37.5	22	182.5	162.5	142.5	120	1.2	13
	25 x 168	2E MN or 2E MU	5.5	37.5	22	212.5	192.5	172.5	150	1.2	13
30 x 250		2E PN or 2E PU	8	44.2	30	311	283	255	224	1.5	28
	30 x 250	2E SN or 2E SU	8	44.2	30	311	283	255	224	1.5	28
40 x 370	**40 x 370**	2E T	9	40	40	448	418	-	-	6	65
50 x 373	**50 x 373**	2E Z	9	40	40	451	421	-	-	6	65

ORDERING INFORMATION

MODEL	TYPE	PAIR	LEAD (Pb)-FREE
2E	BN	...	e

Fixing accessories for RW 8 x 34 AN resistor

Note

• Brackets are sold in pairs

SAP PART NUMBERING GUIDELINES

ACCRF	2E	BN
MODEL	STYLE	TYPE

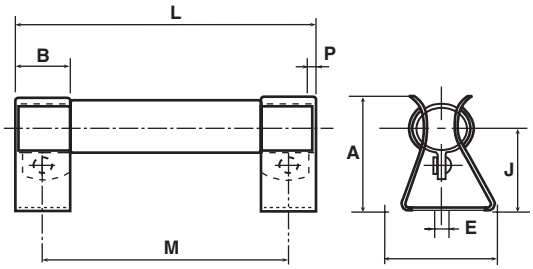
Mounting Accessories For Wirewound Resistors Equipped with B Bands Suitable for RW - RA Models

FEATURES

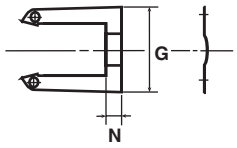
- These flexible clips, of special alloy, provide effective protection against corrosion and extreme working temperatures.
- The stainless steel clip-tightener SC increases fixing stability and improves electrical contact.
- The PC clip-holders are ceramic blocks drilled with 3 threaded holes and guarantee an insulation voltage greater than 10 000 V_{RMS}.
- They can be fitted with 6 types of clip and are supplied unassembled, with a packet containing connecting lugs, screws, washers and rubber wedges.

DIMENSIONS in millimeters

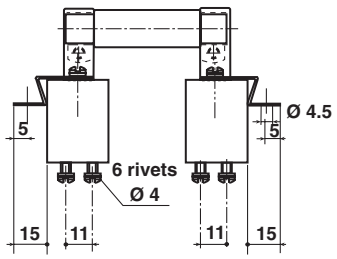
CL CLIPS

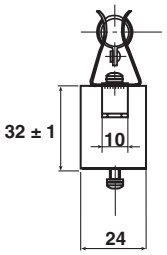


SC CLIP-TIGHTNERS



PC CLIP-HOLDERS





MODEL	STYLE	TYPE	A	B ± 0.5	D	E ± 0.2	J ± 1	L - 0 - 4	M - 0 - 4	P ± 0.3	WEIGHT IN g
RW	**10 x 50**	CL 10	25	10.5	16	4.2	18	57	46.5	2.6	5
RA RW	**13 x 70**	CL 13	30	12.5	18	4.2	24	76	63.5	2	6
RA RW	**16 x 94**	CL 16	36	14	23	4.2	25	101	87	2.5	10
RA RW	**20 x 117**	CL 20	43	16	27	4.2	28	123	107	2	13
RA	**25 x 138**	CL 25	46	17	32	4.2	32	144	127	2	20
RA	**25 x 168**	CL 25	46	17	32	4.2	32	174	157	2	20
RA	**30 x 250**	CL 30	51	20	38	5.2	38	258	238	2.5	25

DIMENSIONS in millimeters					
MODEL	**STYLE**	**TYPE**	**G**	**N ± 0.2**	**WEIGHT IN g**
RW	**10 x 50**	SC 10	18 ± 1	4	0.6
RA RW	**13 x 70**	SC 13	25 ± 1	5	1.2
RA RW	**16 x 94**	SC 16	25 ± 1	5	1.2
RA RW	**20 x 117**	SC 20	29 ± 1	5.5	1.5
RA	**25 x 138**	SC 25	35 ± 1.5	6	2.2
RA	**25 x 168**	SC 25	35 ± 1.5	6	2.2
RA	**30 x 250**	SC 30	41 ± 1.5	7	3.5

ORDERING INFORMATION

	MODEL	**TYPE**	**SPECIAL**	**PAIR**	**LEAD (Pb)-FREE**
For special “electrical traction” resistors (SNCF), quote: CL: BB1 PC: BA9	CL = CLIP CLIP CLIP	10	XXX	...	e

Note

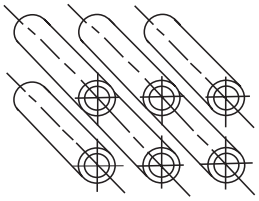
• Clips are sold in pairs

SAP PART NUMBERING GUIDELINES

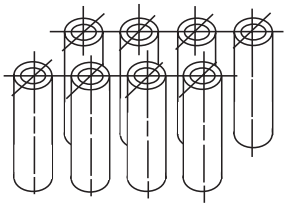
ACCRF	**CL**	**10**
MODEL	STYLE	TYPE

Fixed Wirewound Enamelled High Dissipation Resistors

HORIZONTAL ASSEMBLY



VERTICAL ASSEMBLY



GROUP ASSEMBLY

It is recommended that resistors should be installed with a distance between centres of approximately twice their diameter to aid dissipation efficiency.
Multiplying coefficient applicable to overall power of resistors.

N/E	> 3	3	2	1
1	0.70	0.75	0.80	0.95
2	0.60	0.70	0.75	0.80
3	0.55	0.60	0.70	0.75
4	0.50	0.55	0.65	0.70
5	0.45	0.50	0.60	0.65

L/E	> 3	3	2	1
1	0.85	0.90	0.95	1.00
2	0.65	0.70	0.75	0.92
3	0.65	0.65	0.70	0.90
4	0.65	0.65	0.70	0.88

Notes
- N: Numbers of resistors per stage of line
- L/E: Numbers of stages or line

INTERMITTENT OPERATION OVER LONG PERIODS (NON REPETITIVE)					
TIME (in s)	**60**	**30**	**15**	**5**	**1**
K	2	3	4	12	15

Note
- K: Multiplying coefficient applicable to rated power as a function of duration of load

CYCLIC OPERATION				
ENERGISED PERIOD (in s)	**5**	**10**	**20**	**15**
DE-ENERGISED PERIOD (in s)	**60**	**60**	**60**	**30**
K	10	6	3	2

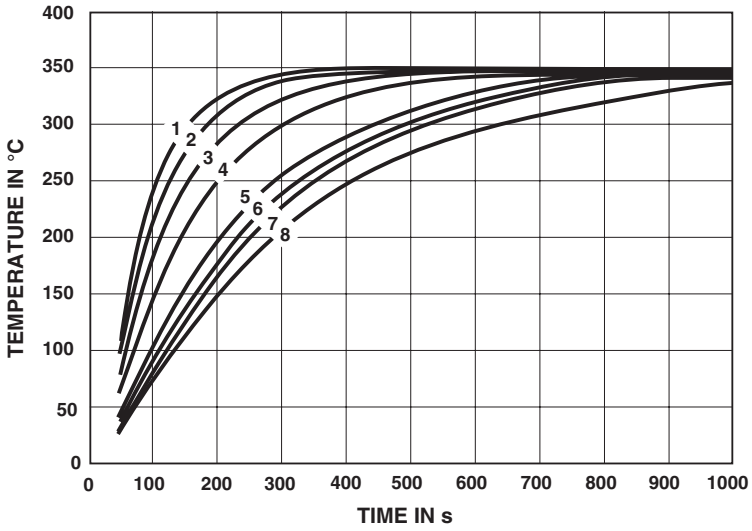
Notes
- K: Multiplying coefficient applicable to rated power
- K: Energised/de-energised period

MOMENTARY OVERLOAD : LESS THAN 100 ms ADMISSIBLE ENERGY FOR ISOLATED OVERLOAD EXPRESSED IN J/Ω

OHMIC VALUE	RW/RWST MODEL									
	8 x 34	10 x 50	13 x 70	16 x 94	2 x 117	25 x 138	25 x 168	30 x 250	40 x 370	50 x 373
10	0.81	3.23	5.21	12.92	18.97	29.07	32.64	76.05	110.16	149.94
100	0.02	0.12	0.51	0.81	2.1	3.23	3.24	8.16	18.6	18.36
1K	3.86×10^{-3}	12.17×10^{-3}	19.89×10^{-3}	50.66×10^{-3}	0.124	0.124	0.192	0.49	1.3	2.04
10K	1.98×10^{-4}	7.65×10^{-4}	19.21×10^{-4}	38.59×10^{-4}	0.02	0.02	0.02	0.03	0.077	0.077

Fixed Wirewound Enamelled High Dissipation Resistors

THERMAL TIME CONSTANT



Heating is also function of time according to the formula :

$$\Delta QT = \Delta QT \text{ max. } (1 - e^{-\frac{t}{\zeta}})$$

ΔQT = heater after t seconds of load
ΔQT max. = Maximum heating
e = Base of Naperian logarithms = 2.718
ζ = Thermal time constant: this varies according to graph of dissipation conditions (see RW wirewound resistor datasheets).

CURVE	STYLE	ζ APPROX. (in s)
1	8 x 34	66
2	10 x 50	78
3	13 x 70	132
4	16 x 94	102
5	20 x 117	204
6	25 x 138	246
7	25 x 168	234
8	30 x 250 40 x 370 50 x 373	300

RESISTOR HEAVILY LOADED OR USED IN A HIGH AMBIENT TEMPERATURE

It is recommended that resistors under these conditions be mounted vertically to facilitate heat exchange, particularly in the case of the larger sizes. Vertical mounting should always be used for tube Ø 25 mm, 30 mm, 40 mm and 50 mm. The central hole must never, of course, be totally covered.

CABINET INSTALLATION

1. Use of forced-air cooling.
   Under good conditions, heat dissipation can be doubled or even trebled ; surface temperature on resistors should not exceed 450 °C.
   Tests should be made by the user.
2. Unventilated cabinet.
   Do not exceed maximum surface temperature.

EXTENSIVE VIBRATION OR SHOCK

AN collars should not be used as fixings. Use the CS collar brackets for Ø 25 mm, 30 mm, 40 mm and 50 mm resistors, or CL clips with SC clip-holders for Ø 10 mm to 30 mm resistors (see datasheet document number 50023).

Wirewound Rheostats

Contents

Wirewound Rheostat/Potentiometer

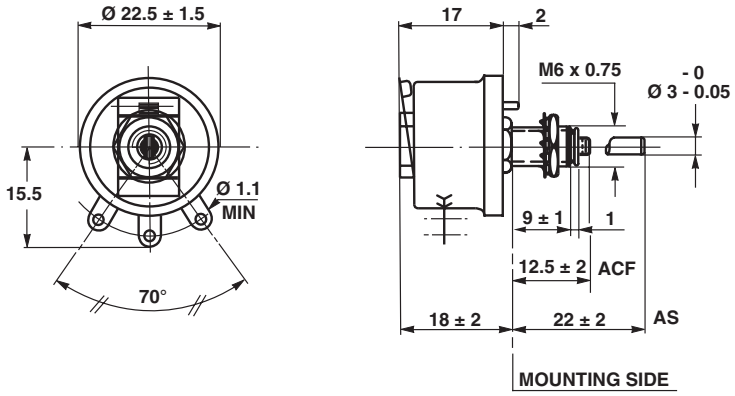
FEATURES

- 12 W at 25 °C
- CCTU 05-03B (PA9)
- Vitreous style
- Compliant to RoHS directive 2002/95/EC

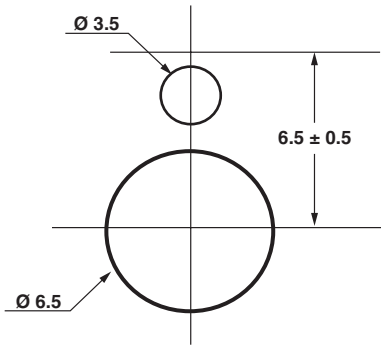
RoHS COMPLIANT

DIMENSIONS in millimeters

RT12-PA9



PANEL CUT OUT DETAILS



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	290° + 15° - 10°
Operating Torque	1 Ncm to 10 Ncm
End Stop Torque	25 Ncm
Unit Weight	18.3 g

ENVIRONMENTAL SPECIFICATIONS

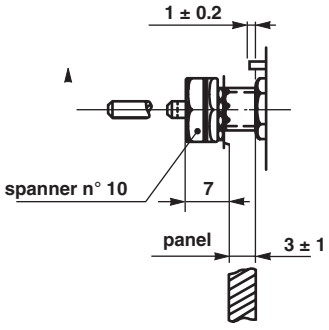
Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

ELECTRICAL SPECIFICATIONS

Ohmic Range	1 Ω to 2.2 kΩ
Tolerance Standard	± 10 %
Power Rating	12 W at 25 °C
Variation Law	Linear
Limiting Element Voltage	300 V
Dielectric Strength	1000 V_{RMS}
Insulation Resistance	10^3 MΩ (500 V_{CC})

LOCKING DEVICE

The spindle locking device can be fitted only to special units equipped with a slotted bushing.
Order reference: B



SPINDLES

Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
3	12.5	With	ACF
3	22	Without	AS

Note

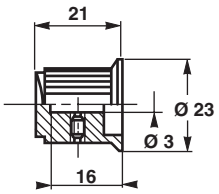
- For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

For technical questions, contact: sfer@vishay.com
Document Number: 50025
Revision: 23-Mar-09

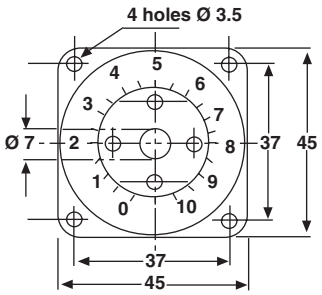
PARTICULAR CHARACTERISTICS

NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER mA
1	3.46	3460
1.5	4.24	2830
2.2	5.14	2340
3.3	6.29	1910
4.7	7.51	1600
6.8	9.03	1330
10	11	1100
15	13.4	900
22	16.3	740
33	19.9	603
47	23.7	505
68	28.6	420
100	34.6	346
150	42.4	283
220	51.4	234
330	62.9	191
470	75.1	160
680	90.3	133
1K	110	110
1.5K	134	90
2.2K	163	74

COMMAND KNOB: 20JF (OPTION)



DIAL: CG45 (OPTION)



MARKING

Vishay Sfernice trademark, series, style, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date

ORDERING INFORMATION

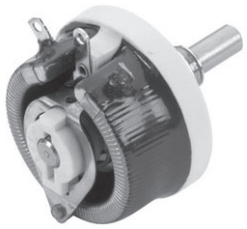
RT	012	AS	1501	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

R	T	0	1	2	A	S	4	7	0	1	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**012**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 3 mm) **ACF**	The three first digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4701** = 4.7 kΩ **48R0** = 48 Ω **0R01** = 0.01 Ω	**J** = 5 % **K** = 10 %	**B** = Bulk BO10 No standard packaging: **N** = Bulk, qty. open	As applicable **Ex** = DXxx

Wirewound Rheostat/Potentiometer

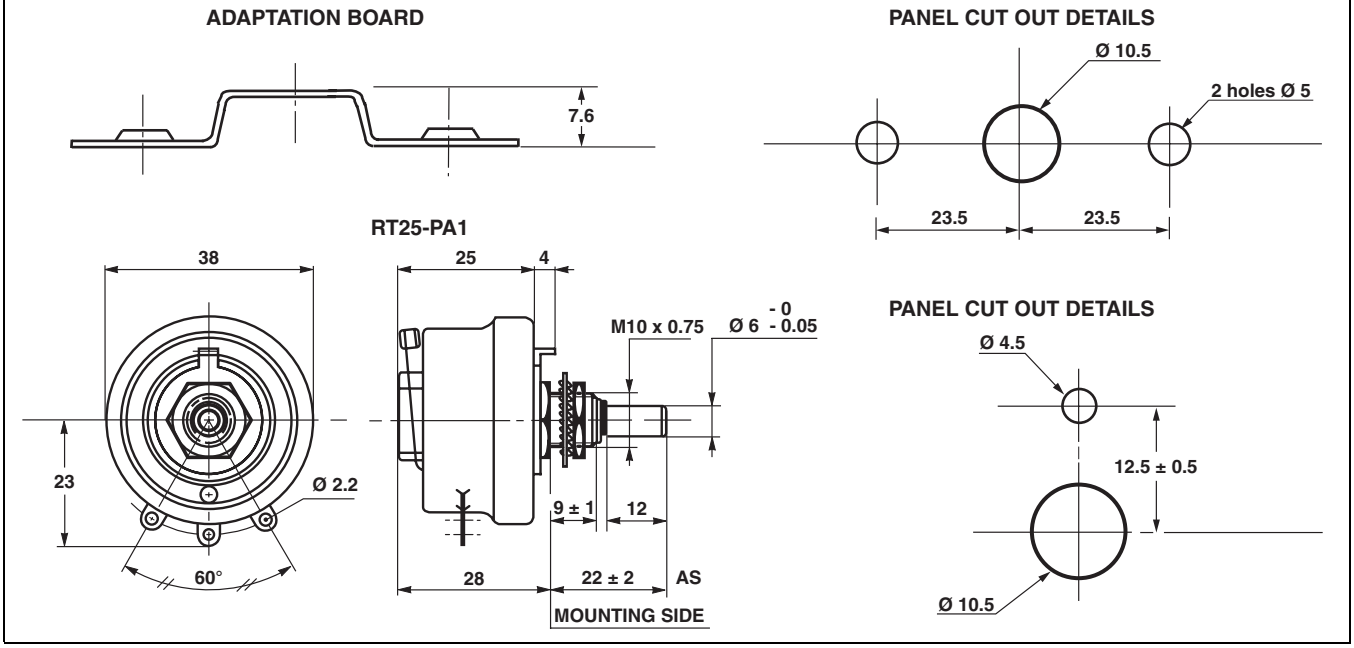


FEATURES

- 25 W at 25 °C
- CCTU 05-03B (PA1)
- Vitreous - RT style
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	300° ± 5°
Operating Torque	1 Ncm to 10 Ncm
End Stop Torque	50 Ncm
Unit Weight	80 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

ELECTRICAL SPECIFICATIONS

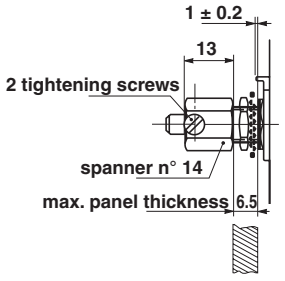
Ohmic Range		1 Ω to 4.7 kΩ
Tolerance Standard		± 10 %
Power Rating		25 W at 25 °C
Variation Law	**Standard**	Linear
	On request	Sectorial winding
Dielectric Strength		1000 V_{RMS}
Insulation Resistance		10^3 MΩ (500 V_{CC})

LOCKING DEVICE

This is supplied as an option.

The available spindle length is according to the panel thickness.

Order reference: DBA6



ADAPTATION BOARD

This enables 2 point mounting instead of bush mounting. The adaptation board is supplied as an option with 2 mounting screws. Consequently, the available spindle length is reduced by 9.5 mm.

PARTICULAR CHARACTERISTICS

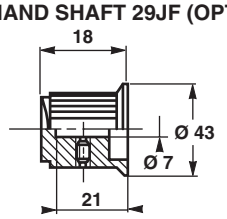
NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER mA
1	5	5000
1.5	6.12	4080
2.2	7.42	3370
3.3	9.08	2750
4.7	10.8	2300
6.8	13	1920
10	15.8	1580
15	19.4	1290
22	23.5	1070
33	28.7	870
47	34.3	730
68	41.2	605
100	50	500
150	61.2	408
220	74.2	337
330	90.8	275
470	108	230
680	130	192
1K	158	158
1.5K	194	129
2.2K	235	107
3.3K	287	87
4.7K	343	73

SPINDLES

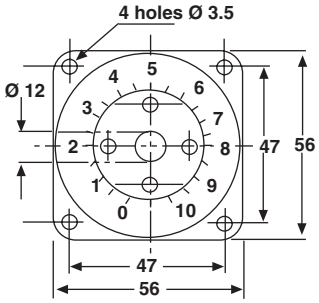
Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
6	22	With	ASF
	25	Without	AM
		With	AMF
	50	Without	AL
6	22	Without	AS

For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

COMMAND SHAFT 29JF (OPTION)



DIAL CG57 (OPTION)



MARKING

Vishay Sfernice trademark, series, style, power rating in watts, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date.

ORDERING INFORMATION

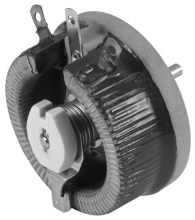
RT	025	ASF	2201	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

R	T	0	2	5	A	S	1	0	R	0	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**025**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 6 mm) **AM** **AMF** **AL** **ASF**	The three first digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **10R0** = 10 Ω **0R01** = 0.01 Ω	**J** = 5 % **K** = 10 %	**B** = Bulk BO10 No standard packaging: **N** = Bulk, qty. open	As applicable **Ex** = DXxx

Wirewound Rheostat/Potentiometer



FEATURES

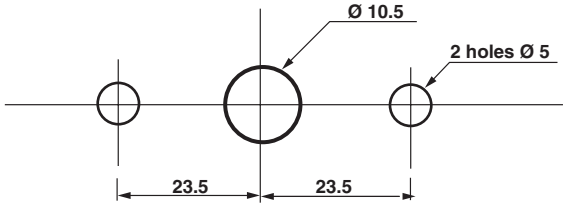
- 55 W at 25 °C
- 40 W at 25 °C
- CCTU 05-03B (PA3)
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

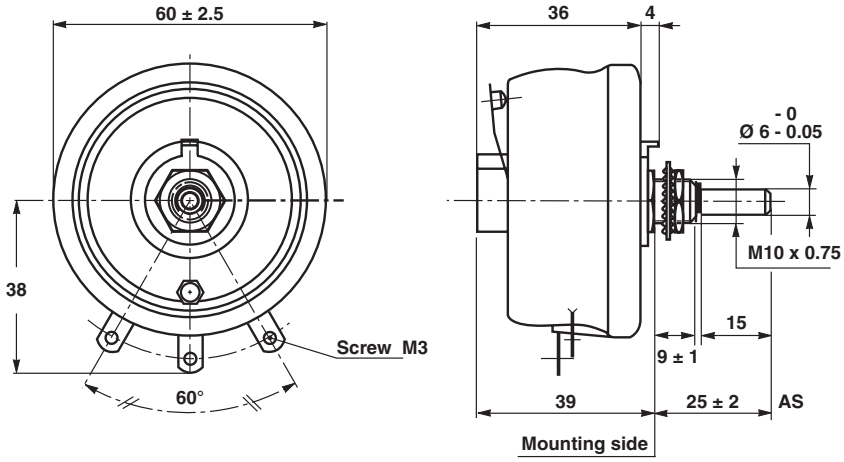
DIMENSIONS in millimeters

ADAPTATION BOARD

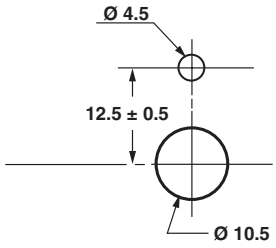
PANEL CUT OUT DETAILS



RT55-PA3



PANEL CUT OUT DETAILS



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	300° ± 5°
Operating Torque	2 Ncm to 15 Ncm
End Stop Torque	100 Ncm
Unit Weight	175 g

ENVIRONMENTAL SPECIFICATIONS

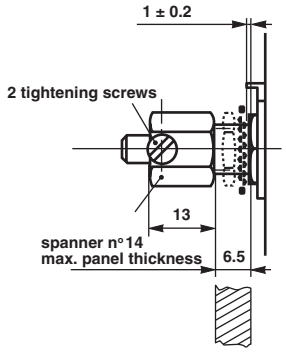
Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

ELECTRICAL SPECIFICATIONS

Ohmic Range		1 Ω to 10 kΩ
Tolerance Standard		± 10 %
Power Rating		55 W at 25 °C
Variation Law	**Standard**	Linear
	On request	Sectorial winding
Limiting Element Voltage		500 V (linear law)
Dielectric Strength		1000 V_{RMS}
Insulation Resistance		10^3 MΩ (500 V_{CC})

LOCKING DEVICE

This is supplied as an option. The available spindle length is according to the panel thickness.
Order reference: DBA6



ADAPTATION BOARD

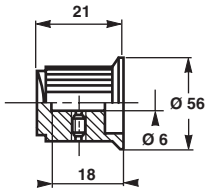
This enables 2 point mounting instead of bush mounting. The adaptation board is supplied as an option with 2 mounting screws.

SPINDLES			
Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
6	22	Without	AD
		With	ADF
	25	Without	AS
		With	ASF
	50	Without	AL

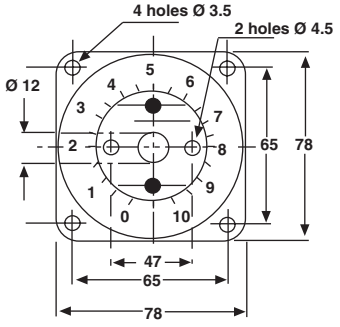
For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

PARTICULAR CHARACTERISTICS		
NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER A
1	7.41	7.41
1.5	9.08	6.05
2.2	11	5
3.3	4.7	6.8
4.7	16.1	3.42
6.8	19.3	2.84
10	23.5	2.35
15	28.7	1.91
22	34.8	1.58
33	42.6	1.29
47	50.8	1.08
68	61.2	0.9
100	74.1	0.74
150	90.8	0.6
220	110	0.5
330	135	0.4
470	161	0.34
680	193	0.28
1K	235	0.23
1.5K	287	0.19
2.2K	348	0.16
3.3K	426	0.13
4.7K	500	0.11
5.6K	500	0.09
10K	500	0.05

COMMAND KNOB 41JF (OPTION)



DIAL CG78 (OPTION)



MARKING

Vishay Sfernice trademark, series, style, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date

ORDERING INFORMATION

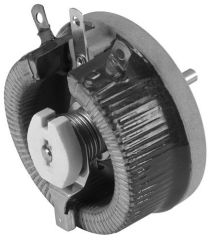
RT	055	AS	4701	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

R	T	0	5	5	A	S	2	2	R	0	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**055**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 6 mm) **AL** **ASF** **AD** **ADF**	The three first digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **22R0** = 22 Ω **0R01** = 0.01 Ω	**J** = 5 % **K** = 10 %	**B** = Bulk BO1	As applicable **Ex** = DXxx

Wirewound Rheostat/Potentiometer



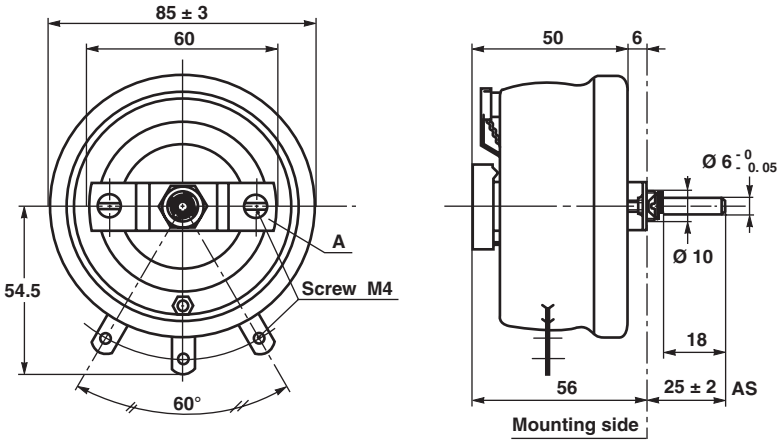
FEATURES

- 100 W at 25 °C
- 70 W at 25 °C
- CCTU 05-03B (PA5)
- Vitreous style
- Compliant to RoHS directive 2002/95/EC

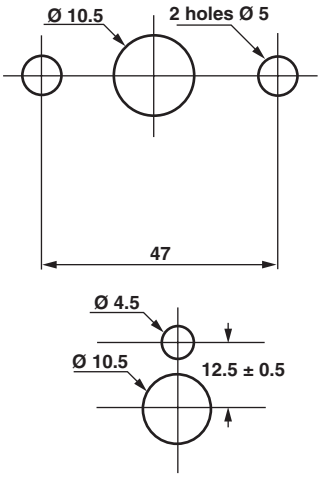
RoHS COMPLIANT

DIMENSIONS in millimeters

RT100-P A5



PANEL CUT OUT DETAILS



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	300° ± 5°
Operating Torque	4 Ncm to 20 Ncm
End Stop Torque	100 Ncm
Unit Weight	400 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

ELECTRICAL SPECIFICATIONS

Ohmic Range		1 Ω to 15 kΩ
Tolerance Standard		± 10 %
Power Rating		100 W at 25 °C
Variation Law	**Standard**	Linear
	On request	Sectorial winding
Limiting Element Voltage		850 V
Dielectric Strength		1500 V_{RMS}
Insulation Resistance		10^3 MΩ (500 V_{CC})

LOCKING DEVICE

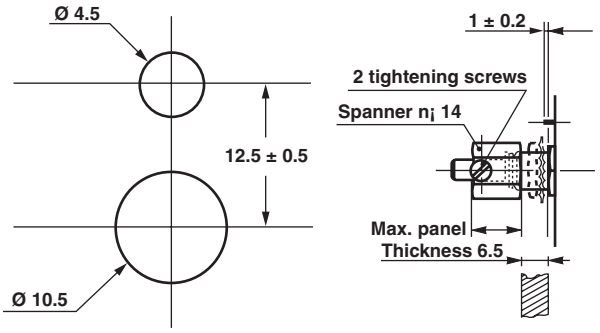
Supplied as an option the spindle locking device can only be fitted to units with control mounting and locating peg.

The part A is removed (see drawing).

The available spindle length is according to the panel thickness.

Order reference: DBA6

PANEL CUT OUT DETAILS

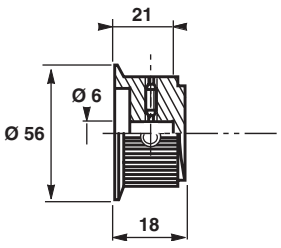


SPINDLES			
Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
6	22	Without	AD
		With	ADF
	25	With	ASF
		Without	AL
6	50	Without	AS

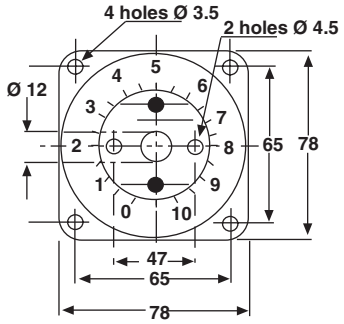
For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

PARTICULAR CHARACTERISTICS		
NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER mA
1	10	10
1.5	12..2	8.16
2.2	14.8	6.74
3.3	18.2	5.50
4.7	21.7	4.61
6.8	26.1	3.84
10	31.6	3.16
15	38.7	2.58
22	46.9	2.13
33	57.4	1.74
47	68.6	1.46
68	82.5	1.2
100	100	1
150	122	0.816
220	148	0.674
330	182	0.550
470	217	0.461
680	261	0.384
1K	316	0.316
1.5K	387	0.258
2.2K	469	0.213
3.3K	574	0.174
4.7K	686	0.146
6.8K	825	0.121
10K	850	0.085
15K	850	0.057

COMMAND KNOB 41JF (OPTION)



DIAL CG78 (OPTION)



MARKING

Vishay Sfernice trademark, series, style, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date

ORDERING INFORMATION

RT	100	AL	6801	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

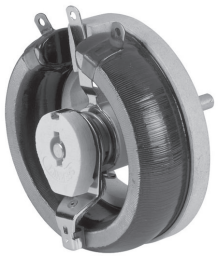
R	T	1	0	0	A	S	2	2	R	0	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**100**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 6 mm) **AL** **ASF** **AD** **ADF**	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **22R0** = 22 Ω **0R01** = 0.01 Ω	**J** = 5 % **K** = 10 %	**B** = Box BO1	As applicable **Ex** = DXxx

RT230

Vishay Sfernice

Wirewound Rheostat/Potentiometer



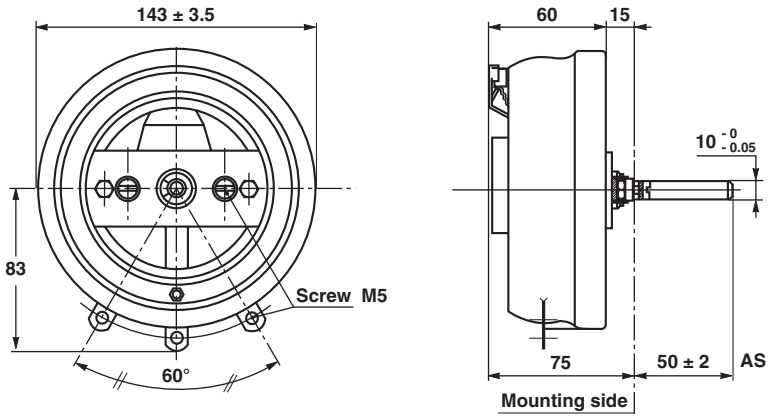
FEATURES

- 250 W at 25 °C
- CCTU 05-03B (PA7)
- Vitreous style
- Compliant to RoHS directive 2002/95/EC

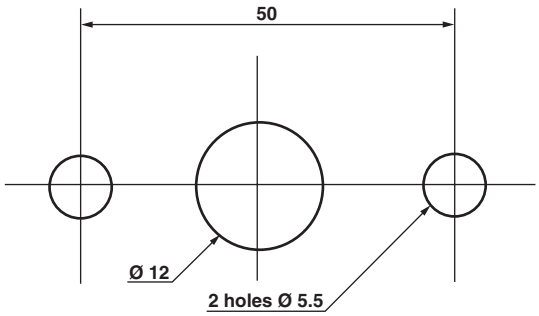
RoHS COMPLIANT

DIMENSIONS in millimeters

RT230-PA7



PANEL CUT OUT DETAILS



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	300° ± 5°
Operating Torque	1 Ncm to 50 Ncm
End Stop Torque	200 Ncm
Unit Weight	1300 g

ENVIRONMENTAL SPECIFICATIONS

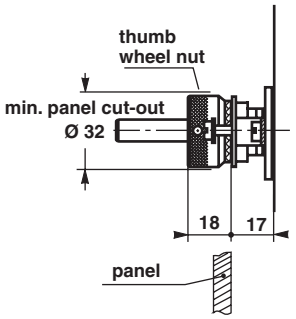
Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

LOCKING DEVICE

This is supplied as an option.

The available spindle length is according to the panel thickness.

Order reference: DBA10



ELECTRICAL SPECIFICATIONS

Ohmic Range		1 Ω to 22 kΩ
Tolerance Standard		± 10 %
Power Rating		250 W at 25 °C
Variation Law	**Standard**	Linear
	On request	Sectorial winding
Limiting Element Voltage		1500 V
Dielectric Strength		2000 V_{RMS}
Insulation Resistance		10^3 MΩ (500 V_{CC})

SPINDLES

Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
10	50	Without	AS

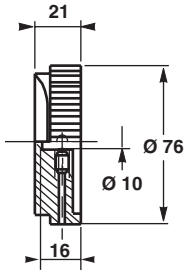
Note

- For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

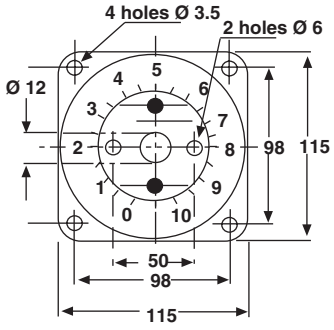
PARTICULAR CHARACTERISTICS

NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER A
1	15.2	15.2
1.5	18.6	12.4
2.2	22.5	10.2
3.3	27.6	8.36
4.7	32.9	7
6.8	31.5	5.82
10	48	4.80
15	58.7	3.92
22	71.1	3.23
33	87.1	2.64
47	104	2.21
68	125	1.84
100	152	1.52
150	186	1.24
220	225	1.02
330	276	0.836
470	329	0.700
680	395	0.582
1K	480	0.480
1.5K	587	0.392
2.2K	711	0.323
3.3K	871	0.264
4.7K	1040	0.221
6.8K	1250	0.184
10K	1500	0.150
15K	1940	0.13
22K	2000	0.091

COMMAND KNOB 60JF (OPTION)



DIAL CG115 (OPTION)



MARKING

Vishay Sfernice trademark, series, style, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date

ORDERING INFORMATION

RT	230	AS	1002	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

R	T	2	3	0	A	S	2	2	R	0	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**230**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 10 mm)	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **22R0** = 22 Ω **0R01** = 0.01 Ω	**J** = 5 % **K** = 10 %	**B** = Box BO1	As applicable **Ex** = DXxx

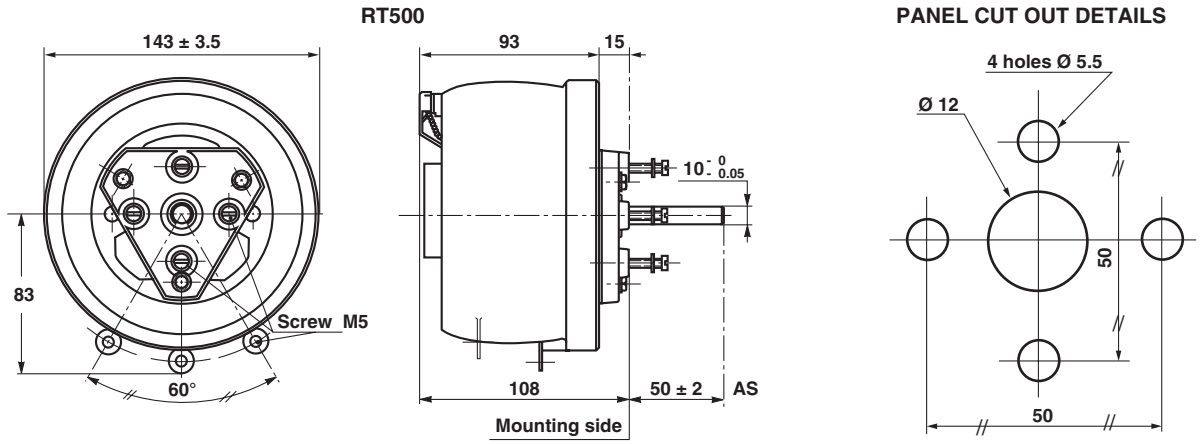
Wirewound Rheostat/Potentiometer

FEATURES

- 500 W at 25 °C
- Vitreous wirewound protection
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

DIMENSIONS in millimeters



MECHANICAL SPECIFICATIONS

Mechanical Protection	Vitreous
Mechanical Travel	300° ± 5°
Operating Torque	10 Ncm to 50 Ncm
End Stop Torque	200 Ncm
Unit Weight	1900 g

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C + 320 °C
Climatic Category	CCTU 454 CEI 55/200/56

ELECTRICAL SPECIFICATIONS

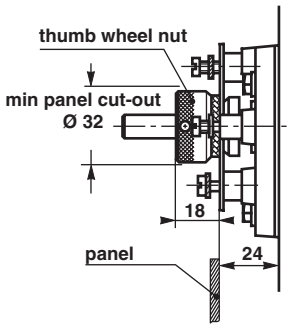
Ohmic Range		1 Ω to 33 kΩ
Tolerance Standard		± 10 %
Power Rating		500 W at 25 °C
Variation Law	**Standard**	Linear
	On request	Sectorial winding
Limiting Element Voltage		3500 V
Dielectric Strength		3500 V_{RMS}
Insulation Resistance		10^3 MΩ (500 V_{CC})

LOCKING DEVICE

This is supplied as an option.

The available spindle length is according to the panel thickness.

Order reference: DBA11



SPINDLES

Ø mm	DISTANCE TO MOUNTING PLATE mm	SCREW DRIVER SLOT	CODE
10	50	Without	AS

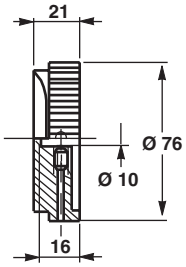
Note

- For any special requirement on request: spindle flats, etc. Please supply detailed drawing.

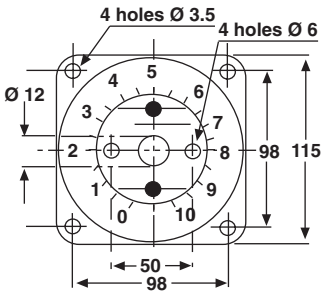
PARTICULAR CHARACTERISTICS

NOMINAL RESISTANCE Ω	MAX. SERVICE VOLTAGE V	MAX. CURRENT THROUGH WIPER A
1	22.4	22.4
1.5	27.3	18.2
2.2	33	15
3.3	40.6	12.3
4.7	48.4	10.3
6.8	58.3	8.57
10	70.7	7.07
15	86.5	5.77
22	105	4.77
33	128	3.89
47	153.2	3.26
68	184.3	2.71
100	224	2.24
150	273	1.82
220	330	1.5
330	406	1.23
470	484	1.03
680	584.8	0.86
1K	707	0.707
1.5K	865	0.577
2.2K	1050	0.477
3.3K	1283	0.389
4.7K	1532	0.326
6.8K	1843	0.271
10K	2240	0.224
15K	2730	0.182
22K	3322	0.151
33K	3500	0.106

COMMAND KNOB 60JF (OPTION)



DIAL CG1 15/4T (OPTION)



MARKING

Vishay Sfernice trademark, series, style, ohmic value (in Ω or kΩ), tolerance (in %), maximum current in A, manufacturing date.

ORDERING INFORMATION

RT	500	AS	2202	K	B	XXX
MODEL	STYLE	SPINDLE	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL DESIGN

GLOBAL PART NUMBER INFORMATION

R	T	5	0	0	A	S	1	0	0	0	K	B

GLOBAL MODEL	SIZE	LOCKING DEVICE (OPT.)	WINDING (OPT.)	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
RT	**500**	**D**	**BXXX** or **BXXXX** As applicable xxx(x) = Internal number	**AS** = Standard (Diam: 10 mm)	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **22R0** = 22 Ω **1000** = 100 Ω	**J** = 5 % **K** = 10 %	**B** = Box BO1	As applicable **Ex** = DXxx

Wirewound Rheostats and Potentiometers
Graded Windings, Ganged Assemblies

DATA REQUIRED TO DEFINE A UNIT

a: Ohmic value of the current load in series with the rheostat
b: Supply voltage of the rheostat + series load
c: Ohmic value of rheostat
d: Maximum current when the rheostat is in short circuit position
e: Current when the rheostat is set to maximum ohmic value
f: Resistance variation law as a function of mechanical travel

To define a graded winding unit a, b and c; or c, d and e or g has to be established.

APPLICATION EXAMPLES

Potentiometer mode

The following data has to be established:

- Potentiometer supply voltage U
- Ohmic value of the controlled current load Z

Note

- If the power to be controlled is small, a linear, variation law rheostat can be used

Ohmic value: $R = \frac{Z}{5}$ and $I = \frac{U^2}{Z}$;

in such case the output current is $I = \frac{6U}{Z}$

Control of lamps

The parameters to be established are:

- Light flux variation required:
  Linear from 100 % to 1 %
  log variation from 100 % to 4 %
  or from 100 % to 20 %
- Lamp supply voltage
- Lamp power range

FEATURES

- Duo, trio or quattro configurations

RHEOSTATS AND POTENTIOMETERS WITH GRADED WINDING: RTS

When the ration $\frac{\text{max. current}}{\text{min. current}}$ exceeds 2, a graded unit may min. current enable a smaller sized unit to be used than an equivalent linear law unit for the same maximum current. Graded windings can also avoid the use of twin units.

Linear relationships are achievable between the variable parameters being controlled and the rheostat command shaft.

All RT size rheostats are available with graded windings except the RT12 size. The resistive wire is protected by a specially Vishay Sfernice formulated enamel. Mechanical and environmental characteristics are identical to the RT series.

GANGED ASSEMBLIES

Rheostats may be ganged mechanically in the following styles:

2 ganged units RTC DUO
3 ganged units RTC TRIO
4 ganged units RTC QUATTRO

The RT12 unit is not suitable for ganged assembly.

Ganged assemblies may comprise:

- Similar sized units, where the ohmic values may be different
- Various sized units where the unit at the top end of the command shaft can be of smaller size

COMMAND SYSTEM

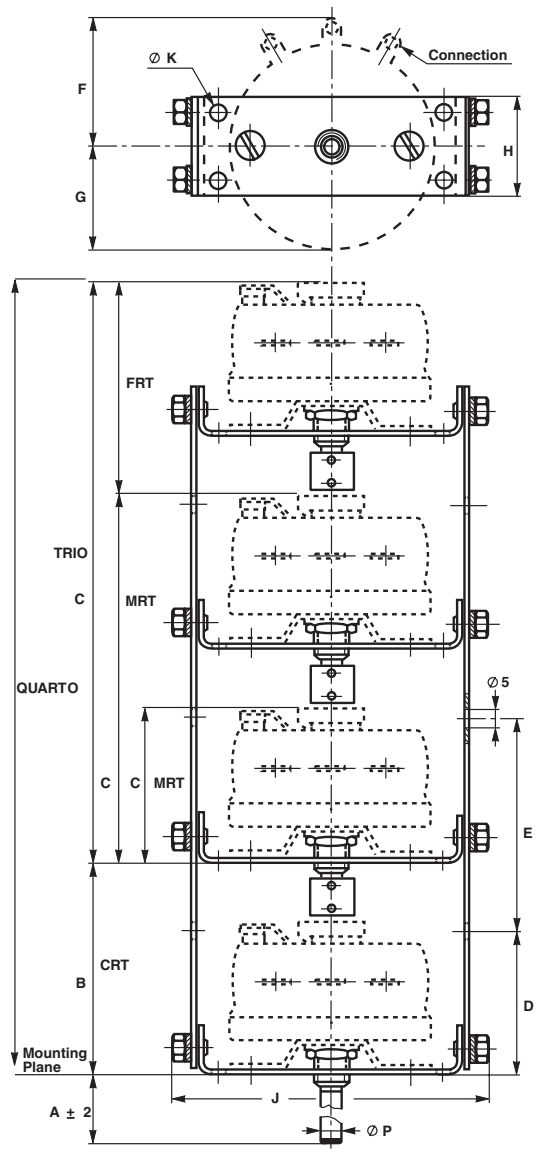
- All units with common command: Code CU
  Shaft locking devices as an option: Code DBA (factory assembled)
- Concentric shafts: Code CC
  Available for double ganged units only: RTC DUO
  The shaft locking device and double mini switch cannot be fitted to concentric shaft
- Command knobs as an option:
  Code JF for standard shaft, code JFP - FSP for concentric shafts

SPECIAL FEATURES

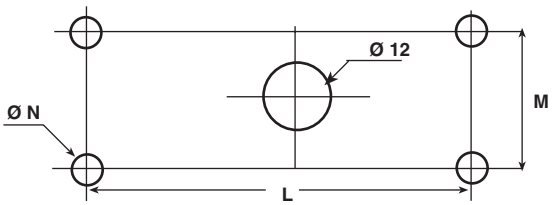
For any special features such as graded windings, centertappings, etc. We would be pleased to receive the details of your particular requirements.

For technical questions, contact: sfer@vishay.com
Document Number: 50031
Revision: 04-Jun-09

DIMENSIONS in millimeters



PANEL CUT-OUT



FEATURES

Mechanical, electrical, and environmental features are similar to the RT series document numbers, 50024, 50025, 50026, 50027, 50028, 50029, 50030

DIMENSIONS											
Series	Type	A	B	C	D	E	F	G	H	J	Ø H
RTC Duo	25	25	52	34.5	30	-	19	23	30	81	3.5
	55	25	63	46	41	-	30	38	30	92	4.5
	100	25	75	58	53	-	42.5	54.5	30	110	M5
	230	50	97	78	78	-	71.5	83	40	170	7
	500	50	128	110	109	-	71.5	83	40	170	7
RTC Trio	25	25	52	86.5	30	52	19	23	30	81	3.5
	55	25	63	109	41	63	30	38	30	92	4.5
	100	25	75	133	53	75	42.5	54.5	30	110	M5
	230	50	97	175	78	97	71.5	83	40	170	7
	500	50	128	238	109	128	71.5	83	40	170	7
RTC Quattro	25	25	52	138.5	30	52	19	23	30	81	3.5
	55	25	63	172	41	63	30	38	30	92	4.5
	100	25	75	208	53	75	42.5	54.5	30	110	M5
	230	50	97	272	78	97	71.5	83	40	170	7
	500	50	128	366	109	128	71.5	83	40	170	7

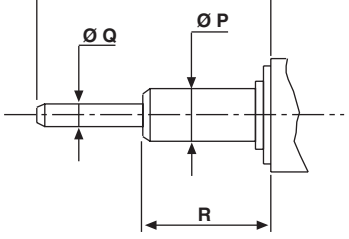
Notes
- RTC Duo 2 ganged units
- RTC Trio 3 ganged units
- RTC Quattro 4 ganged units

PANEL CUT-OUT					
SERIES	DUO - TRIO - QUATTRO				
Type	25	55	100	230	500
L	55	66	62	110	110
M	23	20	20	24	24
Ø N	3.5	4.5	M5	7	7

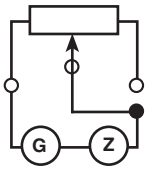
CONCENTRIC SHAFT (1)					
SERIES	TYPE	Ø P	Ø Q	R	S
RTC Duo	25	6	3.5	20	31
	55	6	3.5	21	38
	100	6	3.5	21	45
	230	10	5	25	45
	500	10	5	25	45

Note
(1) 2 ganged units only

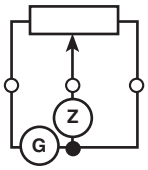
CONCENTRIC SHAFT



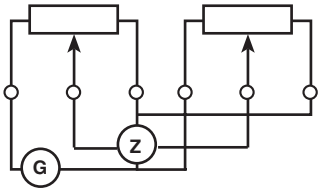
ELECTRICAL DIAGRAM (typical use)



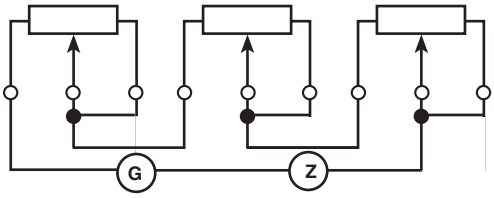
Single rheostat connected



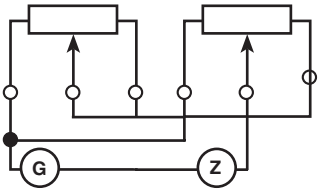
Single potentiometer connected



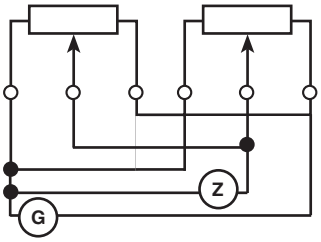
Double potentiometer series connected, load in parallel



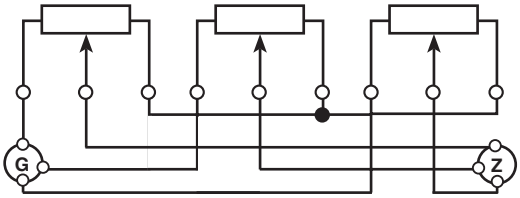
Triple rheostat series connected



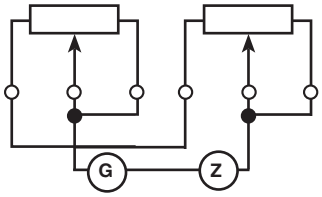
Double rheostat parallel connected, load in series



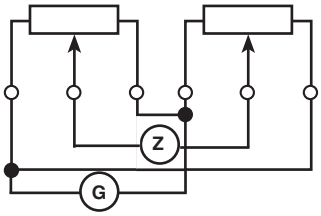
Double potentiometer parallel connected, load in series



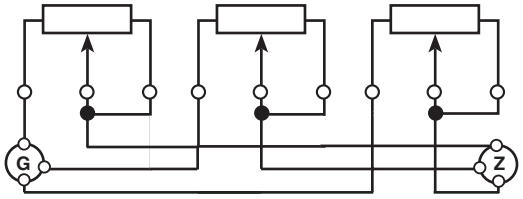
Triple rheostat connected, used for three phase current regulator



Double bridge



Double potentiometer parallel connected, load in parallel



Triple potentiometer connected, used for three phase current regulator

MARKING

Graded winding units: RTS

Vishay Sfernice trademark, series, style, number of graded, windings, ohmic value (in Ω or kΩ), tolerance (in %), maximum current (in A), manufacturing date

Ganged units: RTC: Duo, Trio, Quattro

Vishay Sfernice trademark, series, style, the relative position of each unit in the assembly.
CRT 1st unit (command knob end),
MRT 2nd and/or 3rd unit,
FRT last unit,
ohmic value (in Ω or kΩ), tolerance (in %), maximum current (in A), manufacturing date

Wirewound Rheostats and Potentiometers
Graded Windings, Ganged Assemblies

ORDERING INFORMATION

RTC	DUO	25	CU	2 x 7	10 %	e
SERIES	TYPE	STYLE	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	LEAD (Pb)-FREE
	Trio Quattro		Common Shaft CU Concentric Shaft CC			

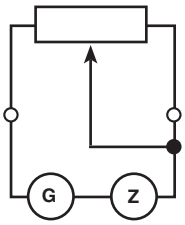
GLOBAL PART NUMBER INFORMATION

T	R	T	1	0	0	C	U	4	7	0	0	K

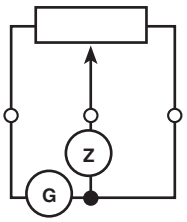
GLOBAL MODEL	SIZE	COMMAND SHAFT	OHMIC VALUE	TOLERANCE	PACKAGING	SPECIAL
DRT (duo) **TRT** (trio) **QRT** (quattro)	**012** **025** **055** **100** **230** **500**	**CU** = Common shaft **CC** = Concentric shaft	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **2002** = 20 kΩ **4700** = 470 Ω **22R0** = 22 Ω **1000** = 100 Ω	**K** = 10 %	**B** = Box BO1	As applicable Ex.: DXxx

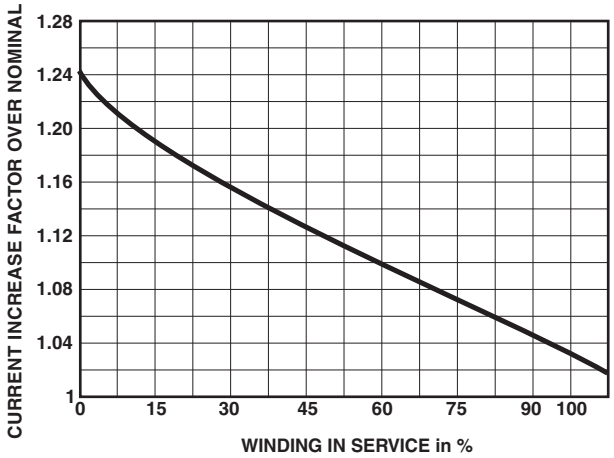
Wirewound Rheostats and Potentiometers Characteristics

RHEOSTAT MODE



POTENTIOMETER MODE





FEATURES

- 12 W to 500 W at 25 °C
- CCTU 05-03B
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

The performance of RT-RTE rheostats exceeds the requirements of specification CCTU 05-03B.
They have been designed for heavy duty applications such as repeated overloads, transients, shock and vibration conditions.

RT VITREOUS SERIES

Six sizes are available capable of dissipating 12 W, 25 W, 55 W, 100 W, 250 W or 500 W at 25 °C.
The resistive wire is protected by a proprietary Vishay Sfernice enamel fired at high temperature and free from any compound that could cause corrosion of the wire.
The maximum operating temperature of the RT series is 320 °C.

GANGED UNITS

Ganged units are available with different combinations of power and ohmic values (see datasheet).

GRADED WINDINGS

These are recommended when the ratio is $\frac{I_{max.}}{I_{min.}} > 2$

MAXIMUM OVERLOAD

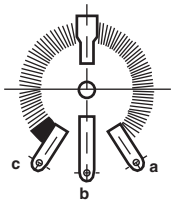
In rheostat use, the winding current decreases in relation to the number of turns being used.
When part of the winding is used the current can be increased in accordance with the graph on the left.
Substantially heavier overloads can be applied in short impulses and we would be pleased to advise on this type of application, on receipt of the following information:
- proposed rheostat usage
- current level
- operating cycles specifying duration of overload “ON”, “OFF” periods.

APPLICATION NOTE

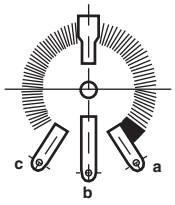
Wirewound Rheostats and Potentiometers Characteristics

SPECIAL FEATURES

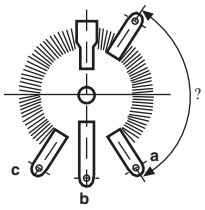
OFF POSITION LEFT
Code No.: 213700



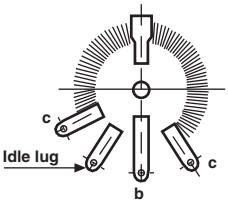
OFF POSITION RIGHT
Code No.: 213600



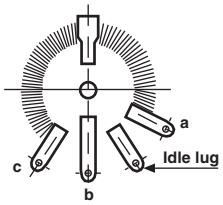
FIXED TAPPINGS, ONE OR MORE
Code No.: RTP
Not available for RT12 and RT500



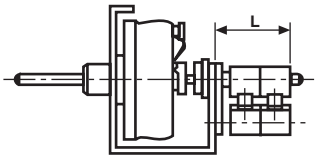
IDLE LUG LEFT
Code No.: DB1
Not available for RT12 and RT500



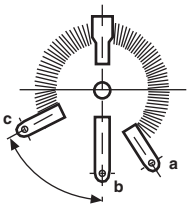
IDLE LUG RIGHT
Code No.: DB2
Not available for RT12 and RT500



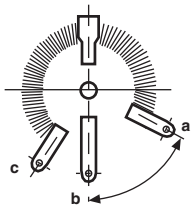
DOUBLE MINI SWITCH
Not available for RT12



REDUCED LEFT TRAVEL
Not available for RT12 and RT500



REDUCED RIGHT TRAVEL
Not available for RT12 and RT500

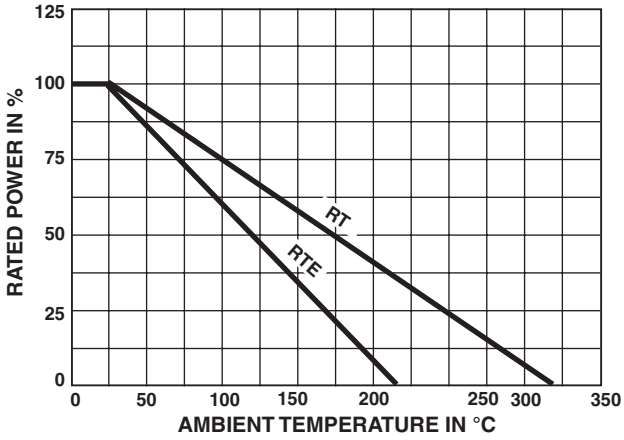


Other special features are available.
Please consult Vishay Sfernice for all of your rheostat requirements.
All the positionings are defined when the shaft end is viewed (contrary to the above windings) clockwise detent.

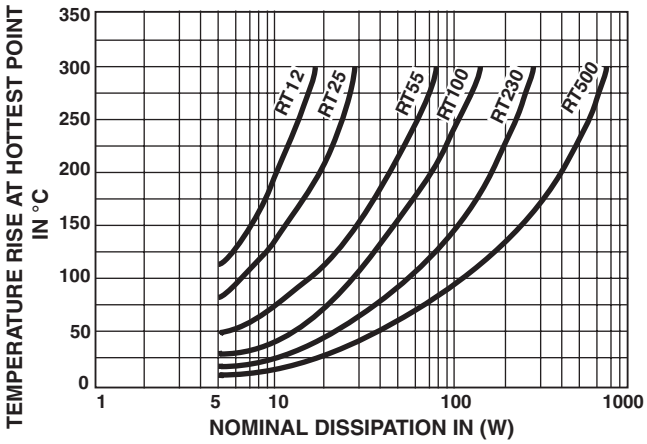
DIMENSIONS in millimeters		
DOUBLE MINI SWITCH FOR SERIES AND SIZE	**CODE**	**L**
RT25	219410	29
RT55	219430	33
RT100	219450	33
RT230	219470	35
RT500	219480	35

Wirewound Rheostats and Potentiometers
Characteristics

POWER RATING



TEMPERATURE RISE



ORDERING INFORMATION

VITREOUS	**RT**	**25**		**L**			**AS**	**3K3**	**± 10 %**	**B010**	**e**
	MODEL	STYLE	SHAFT LOCKING DEVICE Optional	VARIATION LAW	SPECIAL DESIGN Method N° optional	WINDING Optional	COMMAND SHAFT If special, please supply a drawing	OHMIC VALUE	TOL.	PACKAGING	LEAD (Pb)-FREE
ACCESSORIES	**ACC**	**Bouton**		**60JF**		**e**		**DB1**			
	MODEL	KNOB		DIAL		LEAD (Pb)-FREE		SPECIAL FEATURES IDLE LUG LEFT			

ORDERING INFORMATION

VITREOUS	**RT**	**25**	**L**	**AS**	**3301**	**K**	**B**
	MODEL	STYLE	VARIATION LAW		OHMIC VALUE	TOLERANCE	PACKAGING
ACCESSORIES	**ACCRF**	**Bouton**	**60JF**				
	MODEL	TYPE	STYLE				

APPLICATION NOTE

Metal Film Axial Resistors

Contents

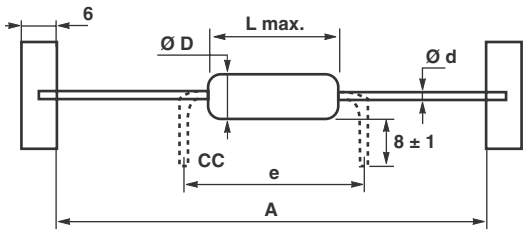
Precision Metal Film Resistors

FEATURES

- 0.063 W to 0.5 W at 70 °C
- Approved according to CECC 40101
- Wide ohmic range from 1 Ω to 4.7 MΩ
- Good initial precision up to ± 0.1 %
- Operating temperatures:
  - 55 °C to + 155 °C for TCR ≥ 25 ppm/°C
  - 25 °C to + 85 °C for TCR ≤ 15 ppm/°C
- Epoxy coating
- Termination: Pure matt tin
- Compliant to RoHS directive 2002/95/EC

Pb-free RoHS COMPLIANT

DIMENSIONS in millimeters



TYPE	Ø D max.	L max.	A ± 1	Ø d	CC e	MAX. UNIT WEIGHT
N.. 3..	1.8	3.9	53	0.5	5.08	0.15 g
N.. 4..	2.5	6.2	53	0.6	NA	0.3 g
N.. 5..	3.3	8.7	53	0.6	NA	0.5 g

TECHNICAL SPECIFICATIONS

MODEL			NT3S	NP3S	NY3	NK3	NT4S	NP4S	NY4	NK4	NT5S	NP5S	NY5	NK5
Power Rating, P_r at + 70 °C			0.125 W	0.25 W			0.25 W	0.5 W			0.5 W			
Stability Class			1 %			2 %	1 %			2 %	1 %			2 %
Preferred Standard Ohmic Values Series			E192 for 0.1 %/0.25 %/0.5 % E96 for 1 %			E24	E192 for 0.1 %/0.25 %/0.5 % E96 for 1 %			E24	E192 for 0.1 %/0.25 %/0.5 % E96 for 1 %			E24
Ohmic Value Range in Relation to: Temperature Coefficient, TCR/ Tolerance	± 15 ppm/°C (1)	± 0.1 % ± 0.25 %	100 Ω 200 kΩ	-	-	-	49.9 Ω 499 kΩ	-	-	-	100 Ω 499 kΩ	-	-	-
		± 0.5 % ± 1 %	10 Ω 200 kΩ	-	-	-	10 Ω 499 kΩ	-	-	-	10 Ω 499 kΩ	-	-	-
	± 25 ppm/°C (2)	± 0.1 % ± 0.25 %	-	100 Ω 511 kΩ	-	-	-	10 Ω 1 MΩ	-	-	-	100 Ω 1 MΩ	-	-
		± 0.5 % ± 1 %	-	10 Ω 511 kΩ	-	-	-	10 Ω 1 MΩ	-	-	-	10 Ω 1 MΩ	-	-
	± 50 ppm/°C (2)	± 0.1 % ± 0.25 %	-	-	-	-	-	-	10 Ω 1 MΩ	-	-	-	10 Ω 1 MΩ	-
		± 0.5 %	-	-	10 Ω 1.5 MΩ	-	-	-	10 Ω 3.32 MΩ	-	-	-	10 Ω 4.7 MΩ	-
		± 1 %	-	-	1 Ω 1.5 MΩ	-	-	-	10 Ω 3.32 MΩ	-	-	-	2.67 Ω 4.7 MΩ	-
	± 100 ppm/°C (2)	± 2 % ± 5 %	-	-	-	1 Ω 1.5 MΩ	-	-	-	10 Ω 3.3 MΩ	-	-	-	2.7 Ω 4.7 MΩ
Limiting Element Voltage $U_{max.\ RMS}$			200 V				350 V				350 V			
Critical Resistance			-	-	160 kΩ		490 kΩ	245 kΩ			245 kΩ			
Thermal Resistance			170 °C/W				145 °C/W				110 °C/W			

Notes

(1) TCR requirement for temperature between - 25 °C and + 85 °C
(2) TCR requirement for temperature between - 55 °C and + 125 °C

ENVIRONMENTAL SPECIFICATIONS

MODEL	NT3S	NP3S	NY3	NK3	NT4S	NP4S	NY4	NK4	NT5S	NP5S	NY5	NK5
Temperature Range	- 25 °C to + 85 °C	- 55 °C to + 155 °C			- 25 °C to + 85 °C	- 55 °C to + 155 °C			- 25 °C to + 85 °C	- 55 °C to + 155 °C		
Climatic Category (LCT/UCT/days)	-	55/125/56			-	55/125/56			-	55/125/56		

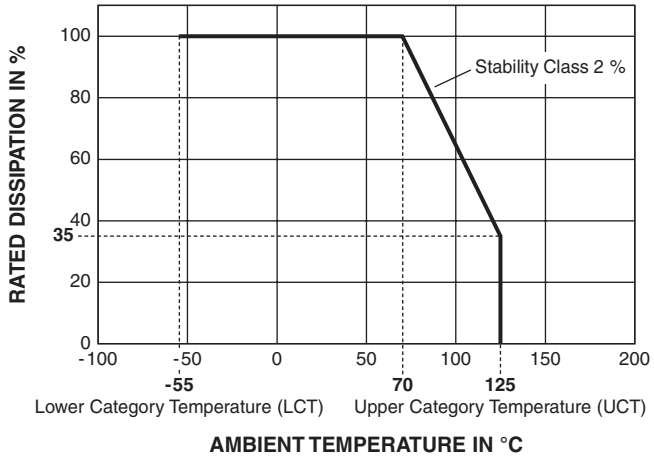
OFFICIAL APPROVAL LIST

MODEL	SPECIFICATION	NATIONAL REFERENCE	CECC REFERENCE	QUALIFIED RANGE	TOLERANCE	P_r at 70 °C
NY3	CECC 40101-002	RS 59Y	EY	10 Ω 301 kΩ	± 1 %	0.125 W
	CECC 40101-002	RS 48Y	AY			0.063 W
	CECC 40101-803	-	AC			0.063 W
NK3	CECC 40101-001	RC 9	DU	10 Ω 510 kΩ	± 2 % ± 5 %	0.250 W
	CECC 40101-001	RC 8U	AU			0.125 W
	CECC 40101-802	-	AV			0.125 W
NP4S	CECC 40101-002	RS 64P	FP	100 Ω 1 MΩ	± 0.5 % ± 1 %	0.250 W
	CECC 40101-002	RS 58P	BP			0.125 W
NY4	CECC 40101-002	RS 71Y	GY	10 Ω 1 MΩ	± 0.5 % ± 1 %	0.500 W
	CECC 40101-002	RS 64Y	FY			0.250 W
	CECC 40101-002	RS 58Y	BY			0.125 W
	CECC 40101-803	-	BC			0.125 W
NK4	CECC 40101-001	RC 32	EU	10 Ω 1 MΩ	± 2 % ± 5 %	0.500 W
	CECC 40101-001	RC 21U	BU			0.250 W
	CECC 40101-802	-	BV			0.250 W
NY5	CECC 40101-002	RS 69Y	HY	10 Ω 1 MΩ	± 0.5 % ± 1 %	0.500 W
	CECC 40101-002	RS 63Y	CY			0.250 W
	CECC 40101-803	-	CC			0.250 W
NK5	CECC 40101-001	RC 31U	CU	10 Ω 1 MΩ	± 2 % ± 5 %	0.500 W
	CECC 40101-802	-	CV			

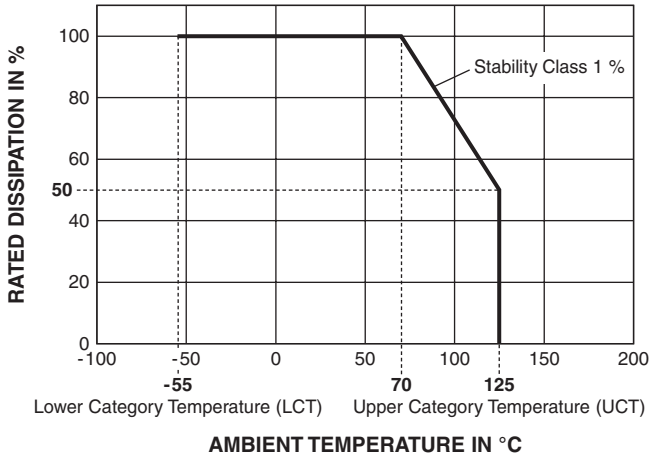
PERFORMANCE					
TEST		CONDITIONS	REQUIREMENTS		TYPICAL DRIFT
			STABILITY CLASS 1 CECC 40101-002/803	STABILITY CLASS 2 CECC 40101-001/802	
Short Time Overload		IEC 60115-1 6.25 P_r or 2 $U_{max.}$ 1 s for 0.063 W/5 s for ≥ 0.125 W	± (0.25 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)	≤ ± 0.05 %
Load Life		IEC 60115-1 90'/30' cycles 1000 h at P_r /70 °C	± (1 % + 0.05 Ω)	± (2 % + 0.1 Ω)	≤ ± 0.25 %
Load Life at Maximum Category Temperature		IEC 60115-1 90'/30' cycles 1000 h at derated P_r /125 °C	± (1 % + 0.05 Ω)	± (2 % + 0.1 Ω)	≤ ± 0.25 %
		IEC 60115-1 1000 h at 155 °C	-	-	
Sheft Life		1 year at ambient temperature	-	-	≤ ± 0.1 %
Seq. A1	**Robustness of Terminations**	IEC 60115-1 IEC 60068-2-21 Test Ua1: Traction 10N/10 s Test U_b: Bending + 90° → - 90° → 0° with 5N Test U_c: Twisting 2 times at 180°	± (0.25 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)	≤ ± 0.1 %
Seq. A2	**Resistance to Soldering Heat**	IEC 60115-1 IEC 60068-2-20 Test Tb Method 1: Solder bath 260 °C/10 s	± (0.25 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)	≤ ± 0.05 %
Seq. B1	**Rapid Change of Temperature**	IEC 60115-1 IEC 60068-2-14 Test Na 5 cycles (30' at LCT/30' at UCT) - 55 °C/125 °C	± (0.25 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)	≤ ± 0.05 %
Seq. B2	**Vibration**	IEC 60115-1 IEC 60068-2-6 Test Fc 10 Hz/500 Hz	± (0.25 % + 0.05 Ω)	± (0.5 % + 0.05 Ω)	≤ ± 0.1 %
Seq. A + B	**Climatic Sequence**	IEC 60115-1 1. Dry heat at 125 °C/16 h (IEC 60068-2-2) 2. Damp heat 55 °C/24 h (IEC 60068-2-30 Test Db) 3. Cold at - 55 °C/2 h (IEC 60068-2-1 Test Aa) 4. Low pressure 25 °C/1 h (IEC 60068-2-13) 5. Damp heat 55 °C/120 h (IEC 60068-2-30 Test Db)	± (1 % + 0.05 Ω)	± (2 % + 0.1 Ω)	≤ ± 0.25 %
Damp Heat, Steady State		IEC 60115-1 IEC 60068-2-78 40 °C/93 % RH/56 days	± (1 % + 0.05 Ω)	± (2 % + 0.1 Ω)	≤ ± 0.5 %

POWER RATING CHARTS

CECC 40101-001/40101-802 NK3/NK4/NK5

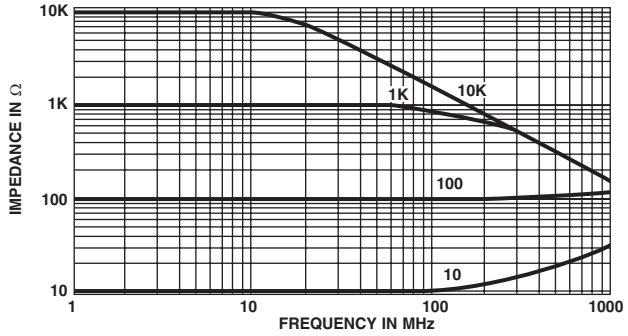


CECC 40101-002/40101-803 NY3/NY4/NP4S/NY5

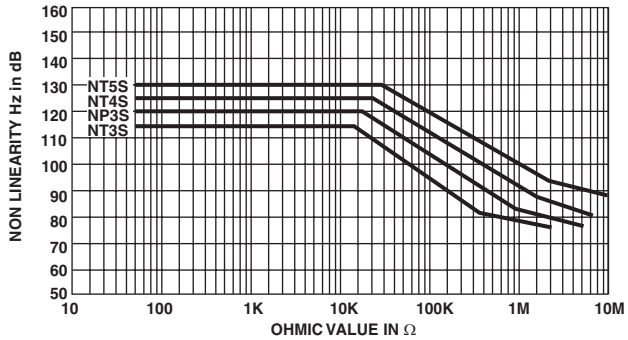


HIGH FREQUENCY

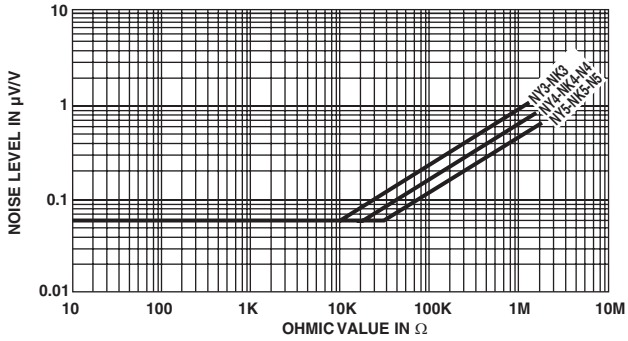
Typical behavior for NK4



THIRD HARMONIC

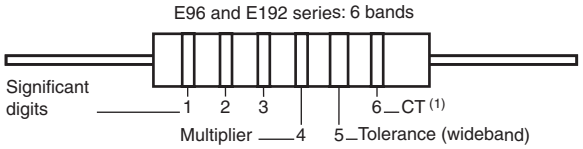


NOISE



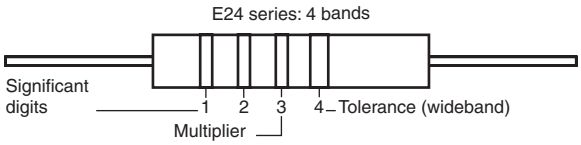
MARKING

Resistor color code chart 6, 5 or 4 bands.



Note

(1) Only for TCR ≤ 25 ppm/°C



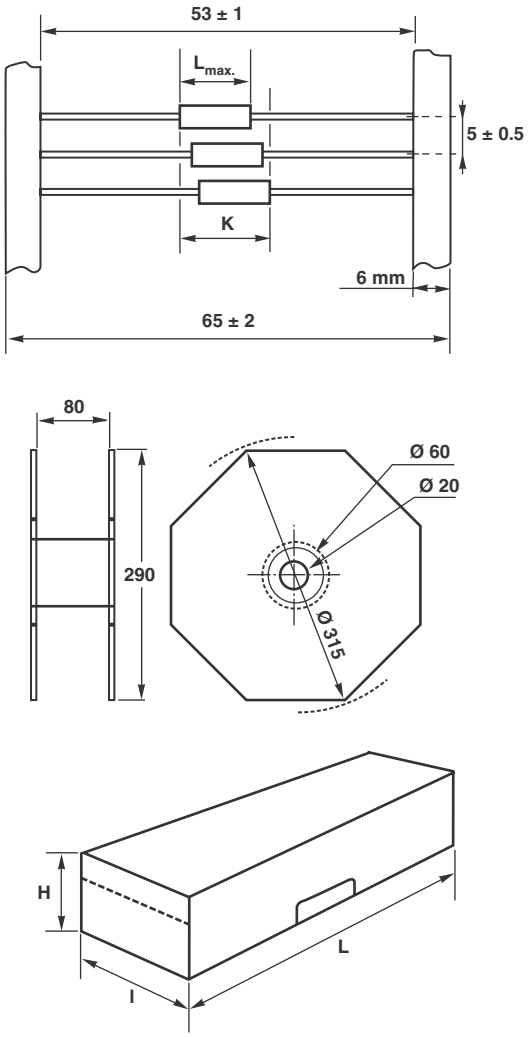
COLOR	DIGIT.	MULTIP.	TOL %	CT ppm/°C
Black	0	1		
Brown	1	10	1	
Red	2	10^2	2	
Orange	3	10^3		± 15
Yellow	4	10^4		± 25
Green	5	10^5	0.5	
Blue	6	10^6	0.25	± 10
Purple	7	10^7	0.1	± 5
Grey	8	10^8		
White	9	10^9		
Silver		10^{-2}		
Gold		10^{-1}	5	

TAPE IN REEL	
SERIES AND MODEL	**QUANTITY PER REEL**
NT4S/NP4S	5000
NK4/NY4	5000
SL3	5000
SL4	5000

TAPED IN AMMOPACK		
SERIES AND MODEL	**QUANTITY PER BOX**	**BOX DIMENSIONS L × I × H (mm)**
NT3S/NP3S	500	260 x 80 x 26
NY3	500	
NK3/SL3	1000	
NT4S/NP4S	500	
NY4	500	
NK4/SL4	1000	260 x 80 x 37
NT5S/NP5S	500	260 x 85 x 28
NK5	500	

TAPED IN BAG		
SERIES AND MODEL	**QUANTITY PER BAG**	**BAG DIMENSIONS (mm)**
NP3S/NT3S	100	85 x 140
NP4S/NT4S		
NP5S/NT5S		
NY3 CC/NK3 CC	500	

PACKAGING



The resistors are required to be inside a window which is the K dimension.

K being equal to the maximum body length of the resistor + 1.4 mm and being centered as per IEC 60286-1 and EIA-296 specification to the tape edges.

ORDERING INFORMATION					
T3	**XXX**	**100 kΩ**	**1 %**	**AM1000**	**e3**
MODEL	CUSTOM DESIGN	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

N	Y	3		1	0	0	0	2	F	A	2	2

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	PACKAGING
NY (50 ppm) **NK** (100 ppm) **NT** (15 ppm) **NP** (25 ppm)	**3** **4** **5**	As applicable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **10002** = 100 kΩ **33001** = 33 kΩ **220R0** = 220 Ω **1R220** = 1.22 Ω	**B** = 0.1 % **C** = 0.25 % **D** = 0.5 % **F** = 1.0 % **G** = 2.0 % **J** = 5.0 %	AM500 = **A20** AM1000 = **A22** BA100 = **S14** BA500 = **S22** TR5000 = **R26**

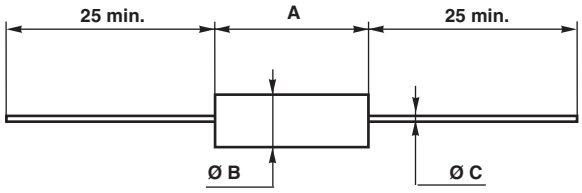
Molded Metal Film Resistors

FEATURES

- 0.25 W to 1 W at 70 °C
- NF C 83-230 (RC21U-31U-41U-32)
- CECC 40 100
- High insulation > 10^7 MΩ
- Great mechanical strength
- Termination = Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES	A	Ø B	Ø C	UNIT WEIGHT IN g
RCMM02	6.5 ± 0.2	$2.5^{\ 0}_{-0.2}$	0.6	0.26
RCMM05	10.2 ± 0.2	3.65 ± 0.1	0.6	0.46
RCMM1	16 ± 0.5	6.2 ± 0.2	0.8	1.30

TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES		RCMM02		RCMM05	RCMM1
CECC 83-230		RC21U	RC32	RC31U	RC41U
CECC 40 100-802		BV	-	CV	-
Power Rating at 70 °C		0.25 W	0.50 W	0.50 W	1 W
Resistance Value Range in Relation to Tolerance	± 5 %	1Ω to 330 kΩ E24	1 Ω to 330 kΩ E24	1 Ω to 1 MΩ E24	1 Ω to 2.2 MΩ E24
	± 2 %	1 Ω to 332 kΩ E48	1 Ω to 332 kΩ E48	1 Ω to 1 MΩ E48	1 Ω to 2.26 MΩ E48
Maximum Voltage		300 V	350 V	350 V	500 V
Critical Resistance		-	245 kΩ	245 kΩ	250 kΩ
Temperature Coefficient	Rated in the range - 55 °C + 155 °C	K2 ≤ ± 100 ppm/°C			
	Typical in the range - 10 °C + 70 °C	≤ ± 50 ppm/°C			
Insulation Resistance (Typical)		≥ 10^7 MΩ (500 VDC)			
Voltage Coefficient		≤ ± 10 ppm/V			
Environmental Specifications		- 65 °C/+ 155 °C/56 days			

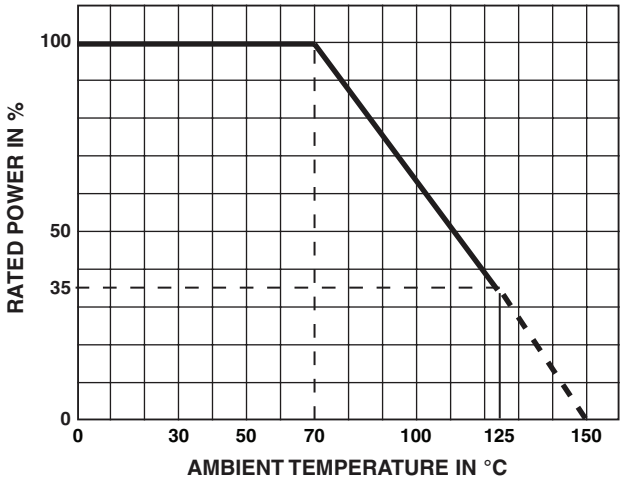
Note

• Undergoes European Quality Insurance System (CECC)

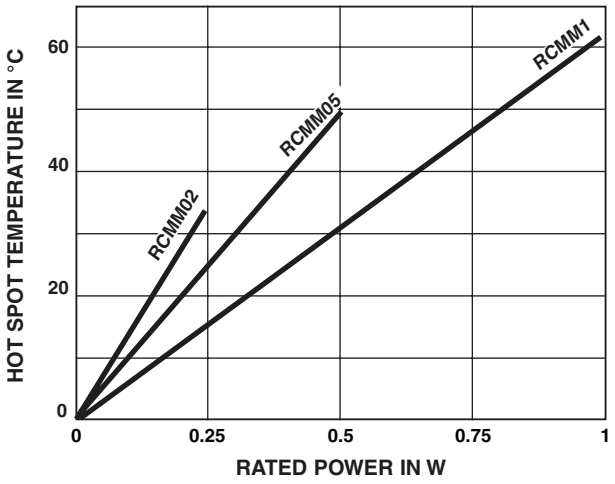
PERFORMANCE			
	CECC 40 100 EN 140100		TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS	REQUIREMENTS	
Load Life at max. Category Temperature	1000 h at 125 °C 35 % of P_n	≤ ± (2 % + 0.1 Ω) Insulation resist. > 1 GΩ	± 0.75 % or 0.05 Ω Insulation resist. 10^6 MΩ
Short Time Overload	2.5 U_m/5 s	≤ ± (0.5 % + 0.05 Ω)	± 0.2 % or 0.05 Ω
Damp Heat Humidity (Steady State)	56 days with low load	≤ ± (2 % + 0.1 Ω) Insulation resist. > 100 MΩ	± 0.5 % or 0.05 Ω Insulation resist. 10^6 MΩ
Rapid Temperature Change	- 55 °C + 125 °C	≤ ± (0.5 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Climatic Sequence	- 55 °C + 125 °C	≤ ± (2 % + 0.1 Ω) Insulation resist. > 100 MΩ	± 0.1 % or 0.05 Ω Insulation resist. 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	≤ ± (0.5 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Vibration	10 Hz to 500 Hz	≤ ± (0.5 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Soldering (Thermal Shock)	+ 260 °C, 10 s	≤ ± (0.5 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Load Life	Cycle 90'/30' 1000 h at P_n at 70 °C	≤ ± (2 % + 0.1 Ω) Insulation resist. > 1 GΩ	± 0.5 % or 0.05 Ω Insulation resist. 10^6 MΩ
Shelf Life	1 year ambient temperature	-	± 0.1 % or 0.05 Ω

Note
- RC41: 15 s

POWER RATING



TEMPERATURE RISE



MARKING

Printed: Vishay Sfernice trademark, series, style, ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing date.
Due to lack of space RCMM02 is printed MM02.

GLOBAL PART NUMBER INFORMATION

R	C	M	M	0	2		1	3	0	1	J	K	S	1	4

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCMM	**02** **05** **10**	As applicacable. Contact us.	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **1301** = 1.3 kΩ **3301** = 3.3 kΩ **22R0** = 22.0 Ω **1R22** = 1.22 Ω	**G** = 2 % **J** = 5 %	**K** = K2, 100 ppm/K	AM500 = **A20** AM1000 = **A22** BAG100 = **S14** BAG50 = **S09**

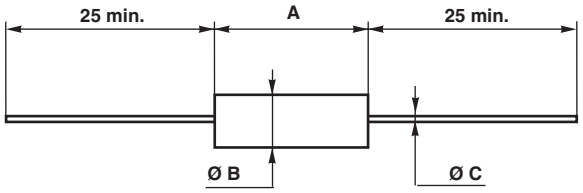
Molded Metal Film High Stability Resistors

FEATURES

- 0.125 W to 0.5 W at 70 °C
- Approval according to CECC 40 101 (002/803)
- High long term stability drift < 0.5 % after 1000 h
- Excellent temperature coefficient ≤ ± 30 ppm/°C in the range - 10 °C to 70 °C
- Excellent initial precision: Up to ± 1 %
- High insulation typical values: 10^6 MΩ
- Termination = Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES AND STYLES	A	Ø B	Ø C	UNIT WEIGHT IN g
RCMS02	6.5 ± 0.2	$2.5^{\ 0}_{-0.2}$	0.6	0.26
RCMS05	10.2 ± 0.2	3.65 ± 0.1	0.6	0.46
RCMS1	16 ± 0.5	6.2 ± 0.2	0.8	1.30

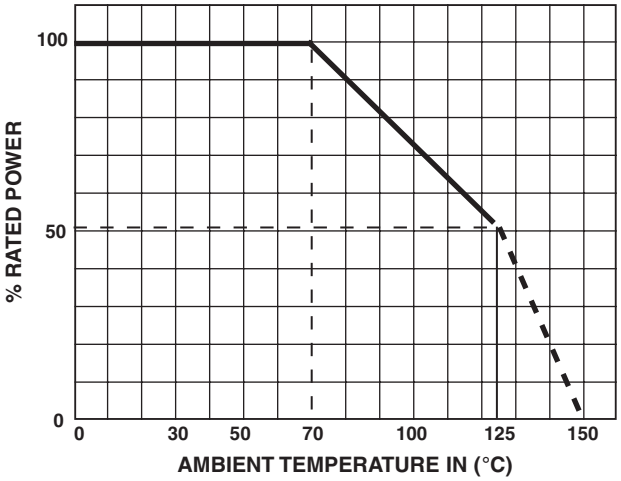
TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES		RCMS02			RCMS05		RCMS1
Reference under CECC 40 101-002 approvals		RS58Y	RS64Y	RS71Y	RS63Y	RS69Y	RS68Y
Reference under CECC 40 101-803 approvals		BC	-	-	CC	-	DC
MIL-R-105509 F equivalent reference		RN55C	-	-	RN60C	-	RN65C
Power Rating at 70 °C		0.125 W	0.250 W	0.500 W	0.250 W	0.500 W	0.500 W
Resistance Value Range in Relation to Tolerance	± 1 % E96	1 Ω to 332 kΩ	1 Ω to 332 kΩ	1 Ω to 332 kΩ	1 Ω to 1 MΩ	1 Ω to 1 MΩ	1 Ω to 2.21 MΩ
Maximum Voltage		300 V	300 V	350 V	350 V	350 V	400 V
Critical Resistance		-	-	-	490 kΩ	245 kΩ	320 kΩ
Temperature Coefficient	Rated in the range - 55 °C + 155 °C	K3 ≤ ± 50 ppm/°C					
	Typical in the range - 10 °C + 70 °C	K3 ≤ ± 30 ppm/°C					
Insulation Resistance (Typical)		≥ 10^7 MΩ (500 VDC)					
Voltage Coefficient		10 ppm/V					
Environmental Specification		- 65 °C/+ 155 °C/56 days					

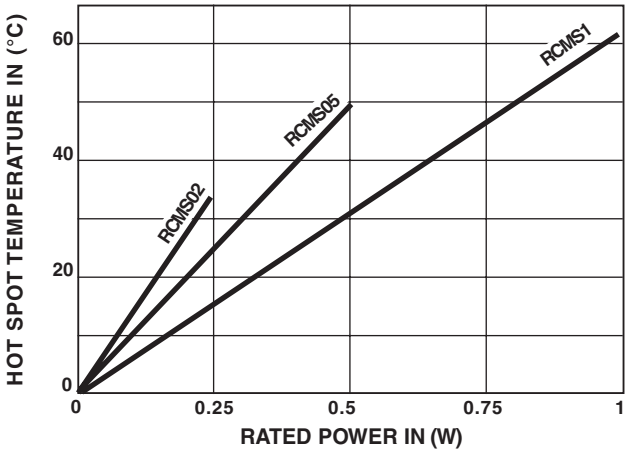
Note
• Undergoes European Quality Insurance System (CECC)

PERFORMANCE			
	CECC 40 100 EN 140-100		TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS	REQUIREMENTS	
Load Life at max. Category Temperature	1000 h at 125 °C 50 % of P_n	≤ ± (1 % + 0.05 Ω) Insulation resist. > 1 GΩ	± 0.5 % or 0.05 Ω Insulation resist. 10^6 MΩ
Short Time Overload	2.5 U_m/5 s limited to 2 U_n	≤ ± (0.25 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Damp Heat Humidity (Steady State)	56 days with low load	≤ ± (1 % + 0.05 Ω) Insulation resist. > 1 GΩ	± 0.5 % or 0.05 Ω Insulation resist. 10^6 MΩ
Rapid Temperature Change	- 55 °C + 125 °C	≤ ± (0.25 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Climatic Sequence	- 55 °C + 125 °C severity 1	≤ ± (0.5 % + 0.05 Ω) Insulation resist. > 1 GΩ	± 0.1 % or 0.05 Ω Insulation resist. 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	≤ ± (1 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Vibration	10 - 500 Hz	≤ ± (0.25 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Soldering (Thermal Shock)	+ 260 °C 10 s	≤ ± (0.25 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Load Life	Cycle 90'/30' 1000 h at P_n at 70 °C	≤ ± (1 % + 0.05 Ω) Insulation resist. > 1 GΩ	± 0.2 % or 0.05 Ω Insulation resist. 10^6 MΩ
Shelf Life	1 year ambient temperature	-	± 0.1 % or 0.05 Ω

POWER RATING



TEMPERATURE RISE



PRACTICAL OPERATING TOLERANCES

Tables 2 and 3 show the basic characteristics and max. values under different stresses. In fact, the values and drifts are maintained to within narrower limits.

Temperature coefficient between - 10 °C and + 70 °C	K3 ≤ 30 ppm/°C	
LONG LIFE 90'/30' cycles ambient temperature 70 °C	1000 h at P_r	± 0.25 %
	10 000 h at P_r	± 0.5 %

Thus, in operation under the specified conditions (P_r at 70 °C) the total drift (load life + TCR) of a RCMS K3 does not exceed ± 0.5 %.

NOISE LEVEL

In a frequency decade, the average noise level increases with the ohmic value and can reach 0.3 µV/V for the highest values. It is non measurable for R_n < 2 kΩ.

MARKING

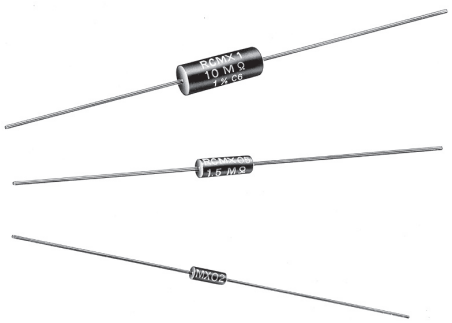
Printed: Vishay Sfernice trademark, series, style NF style (if applicable), ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing data. Due to lack of space RCMS 02 is printed MS 02.

GLOBAL PART NUMBER INFORMATION

R	C	M	S	0	5		4	R	6	4	0	F	H	A	2	0

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCMS	**02** **05** **10**	As applicacable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **4R640** = 4.64 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 %	**H** = K3, 50 ppm/K	AM500 = **A20** AM1000 = **A22** BAG50 = **S09** BAG100 = **S14**

Molded Metal Film High Ohmic Value (to 50 MΩ) Resistors

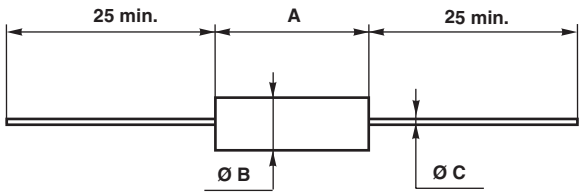


FEATURES

- 0.125 W to 0.5 W at 70 °C
- According to CECC 40 101043
- Resistance range: 300 kΩ to 50 MΩ
- Good initial precision: Up to ± 1 %
- High long term stability drift < 1 % after 1000 h
- Accurate dimensions
- Good insulation typical values: 10 MΩ
- Limiting element voltages: 500 V, 800 V and 1200 V
- Termination = Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free RoHS COMPLIANT

DIMENSIONS in millimeters



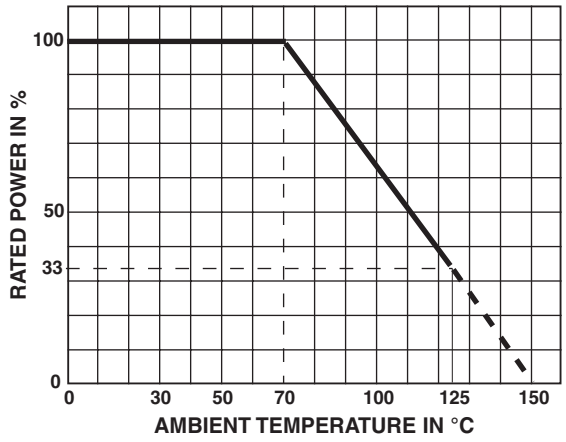
SERIES	DIMENSIONS			
	A	Ø B	Ø C	UNIT WEIGHT IN g
RCMX02	6.5 ± 0.2	$2.5^{\ 0}_{-0.2}$	0.6	0.26
RCMX05	10.2 ± 0.2	3.65 ± 0.1	0.6	0.46
RCMX1	16 ± 0.5	6.2 ± 0.2	0.8	1.30

TECHNICAL SPECIFICATIONS

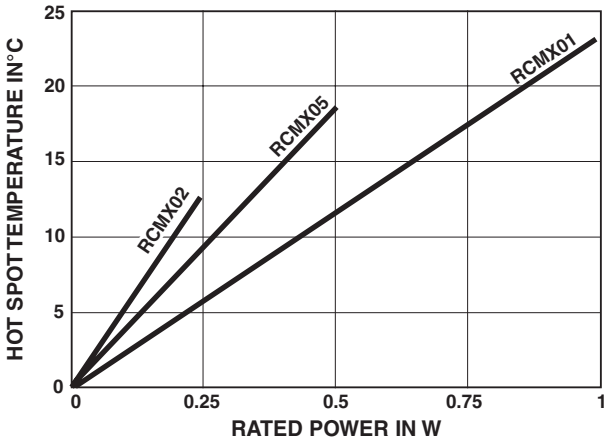
VISHAY SFERNICE SERIES	RCMX02	RCMX05	RCMX1
Reference according to NFC 83 230	RS80	RS81	RS82
Power Rating at 70 °C	0.125 W	0.250 W	0.500 W
Resistance Value Range	300 kΩ to 10 MΩ	1 MΩ to 20 MΩ	2 MΩ to 50 MΩ
Tolerance and Associated Series	± 1 % E96	± 1 % E96	± 5 % E24
Maximum Voltage	500 V	750 V	1000 V
Critical Resistance	2 MΩ	2.55 MΩ	2.87 MΩ
Temperature Coefficient Rated in the Range - 55 °C to + 125 °C	K3 ≤ ± 50 ppm/°C		
Insulation Resistance (Typical)	≥ 10^7 MΩ (500 V_{DC})		
Voltage Coefficient	≤ 10 ppm/V		
Environmental Specifications	- 65 °C/+ 155 °C/10 days		

PERFORMANCE			
ACCORDING TO CECC 40 101043			TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS	REQUIREMENTS	
Load Life at Max. Category Temperature	1000 h at 125 °C 33 % of P_n	≤ ± 1 % Insulation resistance > 1 GΩ	± 2 % at 1000 h Insulation resistance 10^6 MΩ
Short Time Overload	2.5 U_m/5 s limited to 2 U_n	≤ ± 0.25 %	± 0.5 %
Damp Heat Humidity (Steady State)	10 days with low load	≤ ± 1 % Insulation resistance > 10^2 MΩ	± 1.5 %
Rapid Temperature Change	- 55 °C + 125 °C	≤ ± 0.25 %	± 0.25 %
Climatic Sequence	- 55 °C + 125 °C severity 1	≤ ± 1 % Insulation resistance > 100 MΩ	± 1 % Insulation resistance 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	≤ ± 0.25 %	± 0.05 %
Vibration	10 to 500 Hz	≤ ± 0.25 %	± 0.05 %
Soldering (Thermal Shock)	+ 260 °C 10 s	≤ ± 0.25 %	± 0.1 %
Load Life	Cycle 90'/30' 1000 h at P_n at 70 °C	≤ ± 1 % Insulation resistance > 1 GΩ	± 0.5 % Insulation resistance 10^6 MΩ
Shelf Life	1 year ambient temperature	-	± 0.25 %

POWER RATING



TEMPERATURE RISE



PRACTICAL OPERATING TOLERANCES

After 1000 h load life at rated power 90'/30' cycles + 70 °C ambient temperature, the typical total drifts, measured at + 70 °C, are as follows:
Typical total drift = drift due to TCR (K3) + life drift 0.5 %.
Maximum deviation from rated ohmic value including ± 1 % manufacturing tolerance ≤ 1.5 %.

MARKING

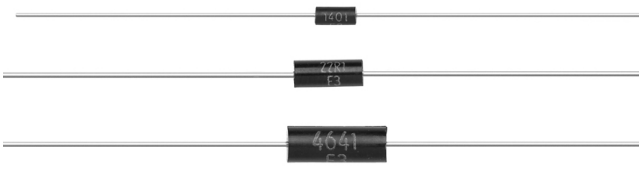
Printed: Vishay Sfernice trademark, series, style, ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing date. Due to lack of space RCMX02 is printed MX02.

GLOBAL PART NUMBER INFORMATION

R	C	M	X	0	2		1	3	0	0	1	J	H	S	1	4

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCMX	**02** **05** **10**	As applicable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **13001** = 13 kΩ **33001** = 33 kΩ **220R0** = 220 Ω **1R220** = 1.22 Ω	**F** = 1 % **J** = 5 %	**H** = K3, 50 ppm/K	AM500 = **A20** AM1000 = **A22** BAG100* = **S14** BAG50* = **S09** *: possible in N/A

Molded Metal Film Very High Stability (< 0.25 % after 1000 h) and Precision (up to 0.1 %) Resistors

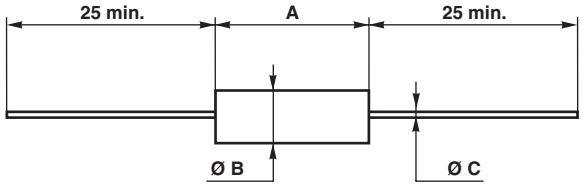


FEATURES

- 0.1 W to 2 W at 70 °C
- EN140-201
- CECC 40 100
- Very high stability: Drift < 0.25 % after 1000 h
- Reduced total excursion: High initial precision (to ± 0.1 %) with low temperature coefficient (down to ± 15 ppm/°C)
- The models in this series are the first ones qualified by the CNES for spatial applications (certificate N°4 dated October 22, 1972)
- Wide range ohmic values 1 Ω to 5 MΩ
- Accurate dimensions, high insulation and great mechanical strength
- High climatic performances: - 65 °C/+ 155 °C/56 days
- Matching tolerance: 0.1 %
- Tracking TCR: 5 ppm/°C
- Termination: Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES	A max.	Ø B max.	Ø C	WEIGHT g
RCMA02	6.7	2.5	0.6	0.26
RCMA05	10.4	4.2	0.6	0.46
RCMA08	16.5	6.4	0.8	1.3
RCMA1	19.3	6.4	0.8	1.5
RCMA2	29	10.2	0.8	4.4
RCMA4	54	10.2	0.8	13

TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES			RCMA02	RCMA05	RCMA08	RCMA1	RCMA2	RCMA4
NF C 83-230			RS58P K4	RS63P K4	RS68P	-	-	-
CECC 40 100-803			BE	CE	DE	-	-	-
Power Rating at 70 °C			0.125 W	0.250 W	0.500 W	0.75 W	1 W	2 W
Resistance Value Range in Relation to - Tolerance - Temperature Coefficient	K3	± 0.2 %	10 Ω to 332 kΩ	10 Ω to 332 kΩ	10 Ω to 1 MΩ	10 Ω to 1 MΩ	10 Ω to 1 MΩ	10 Ω to 2.5 MΩ
		± 0.5 % ± 1 %	1 Ω to 1 MΩ	1 Ω to 1 MΩ	1 Ω to 1.5 MΩ	1 Ω to 2 MΩ	1 Ω to 2.5 MΩ	1 Ω to 5 MΩ
	K4	± 0.1 % ± 0.2 %	10 Ω to 332 kΩ	10 Ω to 332 kΩ	10 Ω to 1 MΩ	10 Ω to 1 MΩ	10 Ω to 1 MΩ	10 Ω to 2.5 MΩ
		± 0.5 % ± 1 %	1 Ω to 1 MΩ	1 Ω to 1 MΩ	1 Ω to 1.5 MΩ	1 Ω to 2 MΩ	1 Ω to 2.5 MΩ	1Ω to 5MΩ
	K5	± 0.1 % ± 0.2 %	10 Ω to 332 kΩ	10 Ω to 332 kΩ	10 Ω to 750 kΩ	10 Ω to 750 kΩ	10 Ω to 1 MΩ	10 Ω to 2 MΩ
		± 0.5 % ± 1 %	10 Ω to 1 MΩ	10 Ω to 1 MΩ	10 Ω to 1.5 MΩ	10 Ω to 2 MΩ	10 Ω to 2.5 MΩ	10 Ω to 2.5 MΩ
Maximum Voltage			300 V	350 V	400 V	500 V	600 V	800 V
Critical Resistance			720 kΩ	490 kΩ	320 kΩ	333 kΩ	360 kΩ	320 kΩ
Temperature Coefficient	Rated in the range - 55 °C to + 155 °C		K3 ≤ ± 50 ppm/°C			K4 ≤ ± 25 ppm/°C		
	Typical in the range 0 °C to + 155 °C		K5 ≤ ± 15 ppm/°C					
Insulation Resistance			> 10^7 MΩ					
Voltage Coefficient			0.0001 %/V					
Environmental Specifications			- 65 °C/+ 155 °C/56 days					

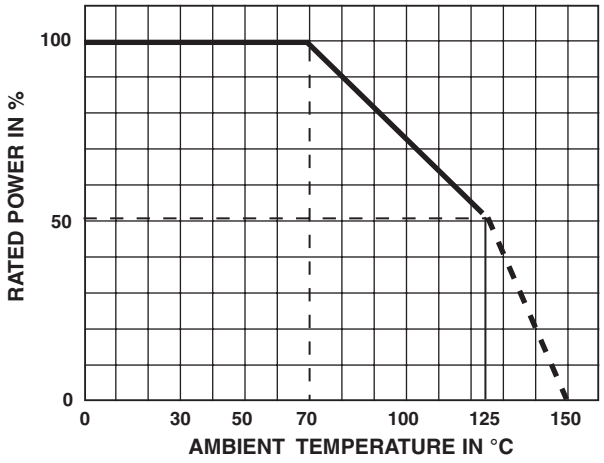
Note

• RS Undergoes European Quality Insurance System (CECC)

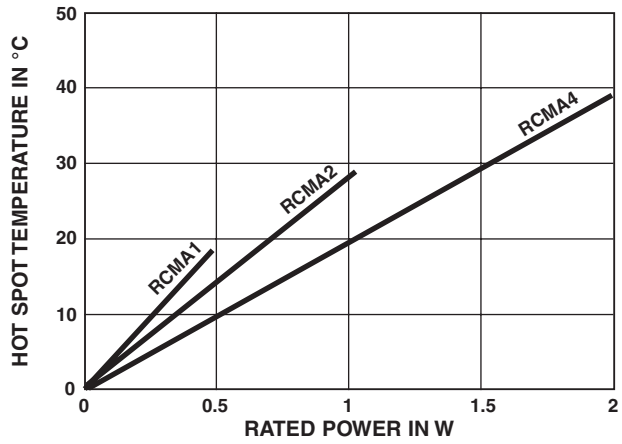
Molded Metal Film Very High Stability (< 0.25 % after 1000 h) and Precision (up to 0.1 %) Resistors

PERFORMANCE			
	CECC 40 100 EN 140-201		TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS STD 202	REQUIREMENTS	
Load Life at Maximum Category Temperature	1000 h at 125 °C 50 % of P_n	≤ ± 1 % Insulation resistance > 1 GΩ	± 0.25 % or 0.05 Ω
Short Time Overload	2.5 U_m/5 s limited to 2 U_n	≤ ± (0.25 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Damp Heat Humidity (Steady State)	56 days with low load	≤ ± (1 % + 0.05 Ω) Insulation resistance > 1 GΩ	± 0.2 % or 0.05 Ω
Rapid Temperature Change	- 55 °C + 155 °C	≤ ± (0.25 % + 0.05 Ω)	± 0.1 % or 0.05 Ω
Climatic Sequence	- 65 °C + 155 °C	≤ ± (1 % + 0.05 Ω) Insulation resistance > 1 GΩ	± 0.25 % or 0.05 Ω Insulation resistance 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	≤ ± (0.25 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Vibration	10 Hz to 500 Hz	≤ ± (0.25 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Soldering (Thermal Shock)	+ 260 °C 10 s	≤ ± (0.25 % + 0.05 Ω)	± 0.05 % or 0.05 Ω
Load Life	Cycle 90'/30' 1000 h at P_n at 70 °C	≤ ± (1 % + 0.05 Ω) Insulation resistance > 1 GΩ	± 0.1 % or 0.05 Ω
Shelf Life	1 year ambient temperature	-	± 0.1 % or 0.05 Ω

POWER RATING



TEMPERATURE RISE



PRACTICAL OPERATING TOLERANCES

Table 2 and 3 show the basic characteristics and maximum values under different stresses. In fact, the values and drifts are maintained to within narrower limits.

Temperature coefficient between - 10 °C and + 70 °C	K5 ≤ ± 10 ppm/°C K4 ≤ ± 15 ppm/°C	
LONG LIFE 90'/30' cycles ambient temperature 70 °C	1000 h at P_r	± 0.05 %
	10 000 h at P_r	± 0.15 %

So, in operation under the specified conditions (P_r at 70 °C) the total drift (load life + TCR) of a RCMA K4 does not exceed ± 0.25 %.

SPECIAL APPLICATIONS

Temperature coefficient tracking to 5 ppm/°C.
Tolerance matching to 0.05 %.
Selection of positive or negative TCR in temperature range of - 20 °C to + 125 °C.
For these applications and other requirements consult Vishay Sfernice.

MARKING

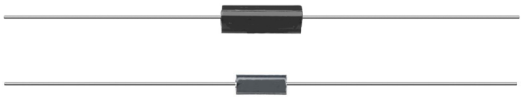
Printed: Vishay Sfernice trademark, series, style (due to lack of space RCMA02 is printed MA02), ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing date.

GLOBAL PART NUMBER INFORMATION

R	C	M	A	0	2		1	3	0	0	1	F	H	S	1	4

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCMA	**02** **05** **08** **10** **20** **40**	As applicable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **13001** = 13 kΩ **33001** = 33 kΩ **220R0** = 220 Ω **1R220** = 1.22 Ω	**B** = 0.1 % **A** = 0.2 % **D** = 0.5 % **F** = 1 %	**H** = K3, 50 ppm/K **E** = K4, 25 ppm/K **D** = K5, 15 ppm/K	AM500 = **A20** BAG100 = **S14** BAG50 = **S09** BAG10 = **S03** BO50* = **B25** *: possible in N/A

Molded Metal Film Resistors
Low Temperature Coefficient, High Precision



The RCME range of metal film resistors represents a significant technical advancement in resistive technology, combining low temperature coefficients with high environmental stabilities, and high frequency performance.

Laser beam trimming gives tolerance accuracies from 0.1 % to 1 %.

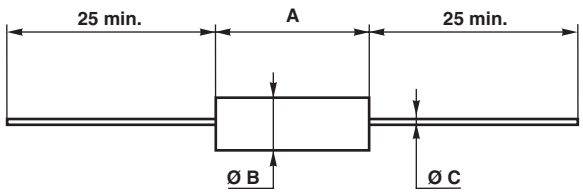
The RCME range effectively bridges the gap that has hitherto existed between the high precision, high stability foil or wirewound technology and conventional film technology.

FEATURES

- 0.125 W to 0.25 W at 85 °C
- Very low temperature coefficient: ± 5 ppm/°C and ± 10 ppm/°C
- Very tight tolerances: Down to ± 0.1 %
- Electrical insulation > 10^7 MΩ
- Climatic category - 65 °C/+ 155 °C /56 days
- Excellent frequency performance
- Termination = Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES	A	Ø B	Ø C	WEIGHT (g)
RCME02	6.5 ± 0.2	2.4 ± 0.1	0.6	0.26
RCME05	10.2 ± 0.2	3.65 ± 0.1	0.6	0.46

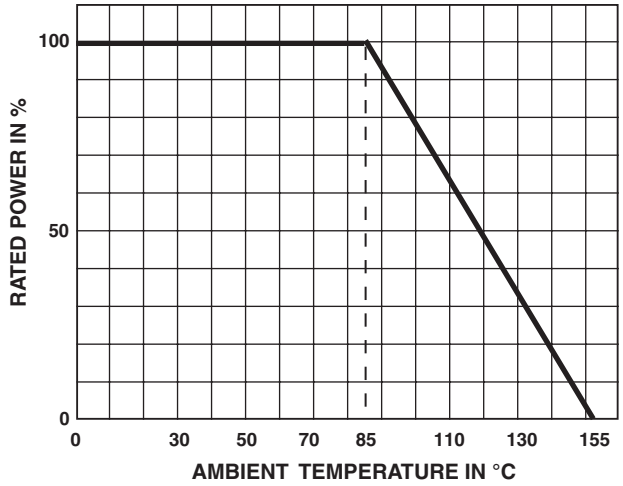
TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES	RCME02	RCME05
Power Rating at 85 °C	0.125 W	0.25 W
Ohmic Range	100 Ω to 750 kΩ	
Resistance Tolerance	± 0.1 %, ± 0.2 %, ± 0.5 %, ± 1 %	
Nominal Temperature Coefficient in the Range - 20 °C to + 85 °C	K6 ≤ ± 10 ppm/°C K8 ≤ ± 5 ppm/°C	
Maximum Voltage	300 V	350 V
Insulation Resistance	> 10^7 MΩ	
Voltage Coefficient	0.0001 %/V	
Environmental Specifications	- 65 °C/+ 155 °C/56 days	

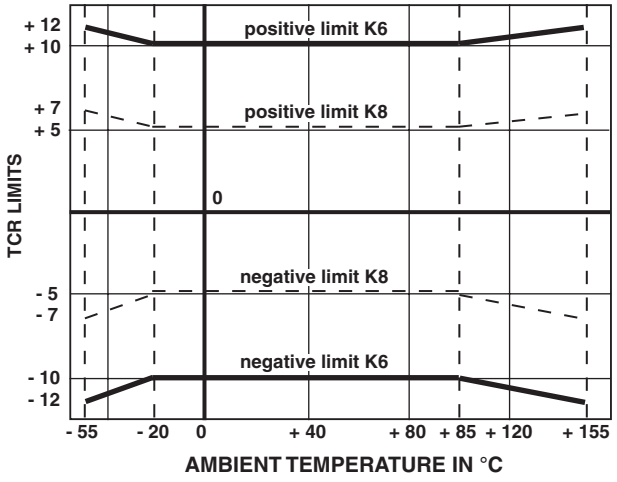
Molded Metal Film Resistors
Low Temperature Coefficient, High Precision

PERFORMANCE		
EN140-100		MAXIMUM VALUES AND DRIFTS
TESTS	CONDITIONS	
Load Life at Maximum Category Temperature	1000 h at + 155 °C/0 % of P_n	± 0.15 % or 0.05 Ω
Short Time Overload	2.5 U_m/5 s limited to 2 U_n	± 0.01 % or 0.05 Ω
Damp Heat Humidity (Steady State)	56 days with low load	± 0.15 % or 0.05 Ω
Rapid Temperature Change	- 55 °C + 155 °C	± 0.05 % or 0.05 Ω
Climatic Sequence	- 55 °C + 155 °C severity 1	± 0.15 % or 0.05 Ω Insulation resistance > 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	± 0.05 % or 0.05 Ω
Vibration	Severity 55B	± 0.05 % or 0.05 Ω
Soldering (Thermal Shock)	+ 260 °C 10 s	± 0.05 % or 0.05 Ω
Load Life	Cycle 90'/30' 1000 h at P_n at 85 °C	± 0.05 % or 0.05 Ω
Shelf Life	1 year ambient temperature	± 0.03 % or 0.05 Ω

POWER RATING



TEMPERATURE COEFFICIENT



The temperature coefficient is guaranteed between - 20 °C to + 85 °C.

The limits of TCR are:
K 8 ± 5 ppm/°C and K 6 ± 10 ppm/°C
For use outside the range - 20 °C or + 85 °C, limiting values of temperature coefficient are given in the graph above.

MARKING

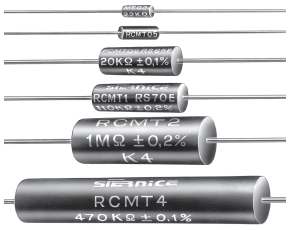
Printed: Vishay Sfernice trademark, series, style (in full or abbreviated), ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing date.

GLOBAL PART NUMBER INFORMATION

R	C	M	E	0	2		1	3	0	0	1	F	Y	S	1	4

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCME	**02** **05**	As applicable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **13001** = 13 kΩ **33001** = 33 kΩ **220R0** = 220 Ω **1R220** = 1.22 Ω	**B** = 0.1 % **A** = 0.2 % **D** = 0.5 % **F** = 1 %	**Y** = K6, 10 ppm/K **Z** = K8, 5 ppm/K	AM500 = **A20** BAG100 = **S14** BAG10 = **S03**

Molded Metal Film High Stability (< 0.25 % after 1000 h) High Temperature (up to 175 °C) Precision Resistors



The performance of the RCMT resistors exceed the requirements of NF C 83-230 standards. They are particularly relevant to the more stringent military and industrial applications especially when high ambient temperatures such as + 175 °C are to be encountered.

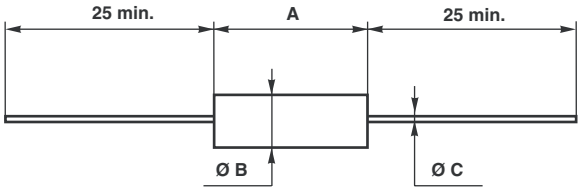
The RCMT resistors are qualified and released to the NF C UTE 83-230 standard styles RS56C, RS60E and C, RS65E and C, RS70E and C.

FEATURES

- 0.1 W to 2 W at 125 °C
- EN140100
- CECC 40 101-044
- High climatic performance - 65 °C/+ 175 °C/56 days
- High long term stability drift < 0.25 % after 1000 h
- Tight temperature coefficient to ± 15 ppm/°C
- Temperature coefficient tracking 5 ppm/°C
- Wide ohmic range from 1 Ω to 5 MΩ
- Tight tolerances up to ± 0.1 %
- Matching tolerance to 0.05 %
- Termination: Pure matte tin
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT

DIMENSIONS in millimeters



SERIES	A max.	Ø B max.	Ø C	WEIGHT g
RCMT01	4.32	2.03	0.4	0.11
RCMT02	6.7	2.5	0.6	0.28
RCMT05	10.4	3.66	0.6	0.46
RCMT08	16.5	6.4	0.8	1.3
RCMT1	19.3	6.4	0.8	1.5
RCMT2	29	10.2	0.8	4.4
RCMT4	54	10.2	0.8	13

TEMPERATURE COEFFICIENT

TCR CODE	TEMPERATURE RANGE	NOMINAL TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	TYPICAL TEMPERATURE COEFFICIENT
K5	0 °C to + 155 °C	± 15 ppm/°C	0 °C to + 70 °C	± 10 ppm/°C
K4	- 55 °C to + 175 °C	± 25 ppm/°C	- 10 °C to + 70 °C	± 15 ppm/°C
K3	- 55 °C to + 175 °C	± 50 ppm/°C	- 10 °C to + 70 °C	± 30 ppm/°C

ENVIRONMENTAL SPECIFICATIONS

Insulation Resistance > 10^7 MΩ

Voltage Coefficient 10 ppm/V

Environmental Specifications - 65 °C/+ 175 °C/56 days

PRACTICAL OPERATING TOLERANCES

After the 10 000 h load life test, at nominal power rating, 90'/30' cycles, + 125 °C ambient temperature, the total actual drifts measured at + 125 °C are the following:

Manufacturing tolerance	± 0.1 %	± 1 %
Drift due to TCR (K4) + life drift	± 0.25 %	± 0.35 %
Max. total deviation from nominal ohmic value, including the manufacturing tolerance	± 0.35 %	± 1.35 %

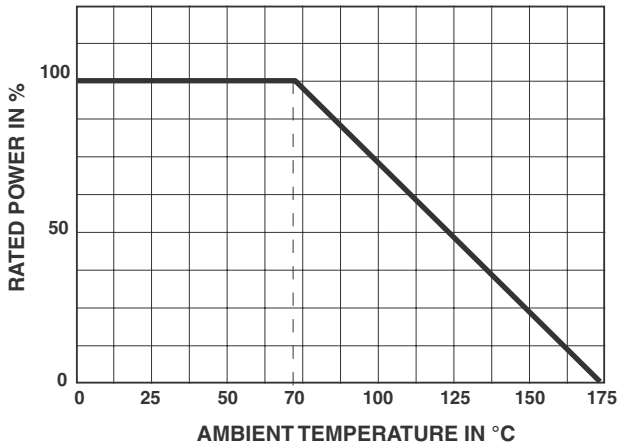
TECHNICAL SPECIFICATIONS

VISHAY SFERNICE SERIES	NF C 83-230 CECC 40 101-044	POWER RATING AT + 70 °C	POWER RATING AT + 125 °C	RESISTANCE VALUE RANGE IN RELATION TO - TEMPERATURE COEFFICIENT - TOLERANCE						MAXIMUM VOLTAGE	CRITICAL RESISTANCE
				K3		K4		K5			
				± 0.2 %	± 0.5 % ± 1 %	± 0.1 % ± 0.2 %	± 0.5 % ± 1 %	± 0.1 % ± 0.2 %	± 0.5 % ± 1 %		
RCMT01 K3	-	0.063 W	0.05 W	10 Ω 511 kΩ	1 Ω 511 kΩ	49.9 Ω 100 kΩ	49.9 Ω 511 kΩ	100 Ω 100 kΩ	100 Ω 100 kΩ	200 V	-
RCMT01 K4	-										
RCMT02 K3	RS 56C	0.125 W	0.1 W	10 Ω 332 kΩ	1 Ω 332 kΩ	10 Ω 332 kΩ	1 Ω 332 kΩ	10 Ω 100 kΩ	10 Ω 332 kΩ	300 V	-
RCMT02 K4	RS 56E										
RCMT05 K3	RS 60C	0.25 W	0.125 W	10 Ω 332 kΩ	1 Ω 1 MΩ	10 Ω 332 kΩ	1 Ω 1 MΩ	10 Ω 332 kΩ	10Ω 1 MΩ	350 V	980 kΩ
RCMT05 K4	RS 60E										
RCMT08 K3	RS 65C	0.5 W	0.25 W	10 Ω 1 MΩ	1 Ω 1.5 MΩ	10 Ω 1 MΩ	1 Ω 1.5 MΩ	10 Ω 750 kΩ	10 Ω 1.5 MΩ	400 V	640 kΩ
RCMT08 K4	RS 65E										
RCMT1 K3	RS 70C	1 W	0.5 W	10 Ω 1 MΩ	1 Ω 2 MΩ	10 Ω 1 MΩ	1 Ω 2 MΩ	10 Ω 750 kΩ	10 Ω 2 MΩ	500 V	500 kΩ
RCMT1 K4	RS 70E										
RCMT2 K3	-	2 W	1 W	10 Ω 1 MΩ	1Ω 2.5 MΩ	10 Ω 1 MΩ	1 Ω 2.5 MΩ	10 Ω 1 MΩ	10Ω 2.5 MΩ	600 V	360 kΩ
RCMT2 K4	-										
RCMT4 K3	-	4 W	2 W	10 Ω 2.5 MΩ	1 Ω 5 MΩ	10 Ω 2.5 MΩ	1 Ω 5 MΩ	10 Ω 2 MΩ	10 Ω 2.5 MΩ	800 V	320 kΩ
RCMT4 K4	-										

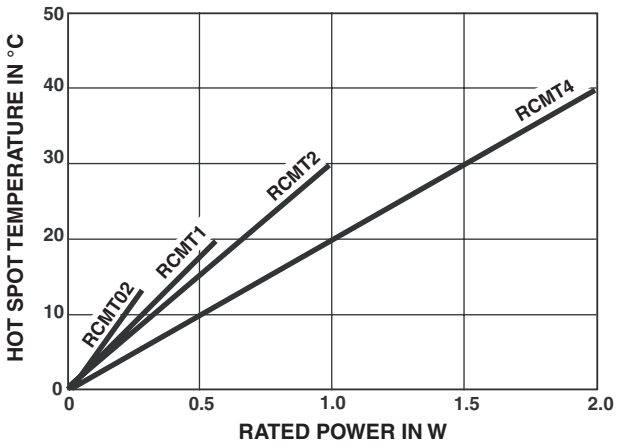
Note

• Undergoes European Quality Insurance System (CECC)

POWER RATING



TEMPERATURE RISE



PERFORMANCE			
EN140100 - CECC 40 101-044			TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS	REQUIREMENTS	
Dielectric Voltage	2 U_n/1 min	± 0.25 %	< ± 0.05 % or 0.05 Ω
Short Time Overload	2.5 U_m/5 s limited to 2 U_n	± 0.25 %	± 0.05 % or 0.05 Ω
Load Life at Maximum Category Temperature	1000 h at + 155 °C 0 % of P_r	± 0.5 %	± 0.25 % or 0.05 Ω
Damp Heat Humidity (Steady State)	56 days with low load	± 0.5 %	± 0.2 % or 0.05 Ω Insulation resistance > 10^6 MΩ
Rapid Temperature Change	- 55 °C + 175 °C	± 0.1 %	± 0.05 % or 0.05 Ω
Climatic Sequence	- 65 °C + 175 °C severity 1	± 0.5 % Insulation resistance > 10^3 MΩ	± 0.2 % or 0.05 Ω Insulation resistance > 10^6 MΩ
Terminal Strength	Pull - twist - 2 bends	± 0.1 %	± 0.05 % or 0.05 Ω
Vibration	Severity 55 B	± 0.1 %	± 0.05 % or 0.05 Ω
Soldering (Thermal Shock)	+ 260 °C 10 s	± 0.1 %	± 0.05 % or 0.05 Ω
Load Life	Cycle 90'/30' 70 °C ambient, 1000 h at P_n	± 0.5 %	± 0.15 % or 0.05 Ω
	Cycle 90'/30' 70 °C ambient, 10 000 h at P_n	-	± 0.25 % or 0.05 Ω
Shelf Life	1 year ambient temperature	-	< ± 0.05 %

NOISE LEVEL

In a frequency decade, the average noise level is 0.1 µV/V for models RCMT08, RCMT1, RCMT2 and RCMT4 in all ohmic values. It progressively increases as a function of the ohmic value and can reach 0.2 µV/V for the highest values of models RCMT02 and RCMT05 (0.1 µV/V for R < 10 kΩ).

SPECIAL APPLICATIONS

Temperature coefficient tracking to 5 ppm.
Tolerance matching to 0.05 %.
Selection of positive or negative TCR in temperature range of - 20 °C to + 125 °C.
For these applications and other requirements consult Vishay Sfernice.

RECOMMENDATION

The lower the ohmic value, the more important the influence of lead resistance is on measurements. The nominal resistance value is therefore measured at a distance of 5 mm from resistor body.

MARKING

Printed: series, style, NF style if applicable, ohmic value (in Ω), tolerance (in %), temperature coefficient, manufacturing date. Due to lack of space, RCMT02 is referenced as MT02.

GLOBAL PART NUMBER INFORMATION

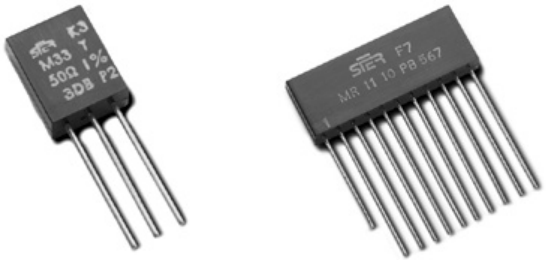
R	C	M	T	0	2		1	3	0	0	1	F	H	S	1	4

GLOBAL MODEL	SIZE	SPECIAL	OHMIC VALUE	TOLERANCE	TEMPERATURE COEFFICIENT	PACKAGING
RCMT	**01** **02** **05** **08** **10** **20** **40**	As applicable. Contact us.	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **13001** = 13 kΩ **33001** = 33 kΩ **220R0** = 220 Ω **1R220** = 1.22 Ω	**B** = 0.1 % **A** = 0.2 % **D** = 0.5 % **F** = 1 %	**H** = K3, 50 ppm/K **E** = K4, 25 ppm/K **D** = K5, 15 ppm/K	AM500 = **A20** BAG100 = **S14** BAG50 = **S09** BAG10 = **S03** BO50* = **B25** *: possible in N/A

Networks and Shunt Resistors

Contents

Resistor Networks
Metal Film Technology



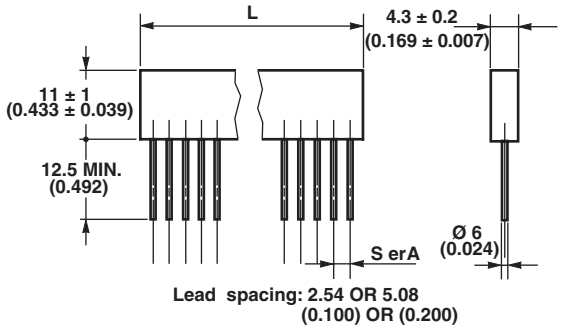
FEATURES

- RCMA 02 metal film
- RCMX 02 metal film
- Temperature range - 55 °C/+ 125 °C
- Tolerance and/or temperature coefficient
  Tolerance tracking 0.1 % between two resistors
  TCR tracking 2 ppm/°C between two resistors
- Compliant to RoHS directive 2002/95/EC

Please consult Vishay Sfernice for special requirements.

Pb-free
RoHS COMPLIANT

DIMENSIONS in millimeters (inches)



SERIES	MR3..	MR4..	MR5..	MR7..	MR11..
S = 2.54 (0.100)	8.6	11.5	13.6	19.7	28.8
A = 5.08 (0.200) (1)	13.6	19.7	On request		

Note
(1) On request

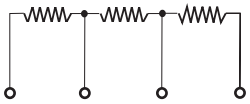
ELECTRICAL SPECIFICATIONS (per resistor)

Power Rating at 70 °C	0.1 W
Resistance Tolerance	± 0.1 % to ± 5 %
Ohmic Value Range	0.1 Ω to 10 MΩ
Temperature Coefficient Available	± 5 to ± 50 ppm/°C
Maximum Power Rating Per Packaging	Number of resistors x 0.1 W

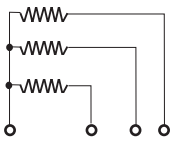
AVAILABLE CONFIGURATIONS

RESISTOR NETWORKS

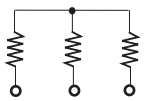
S SERIES



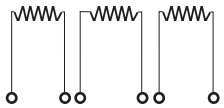
P
PARALLEL + COMMON



PARALLEL

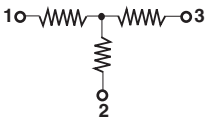


E
INDEPENDENT

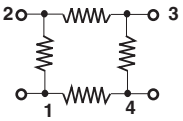


ATTENUATORS

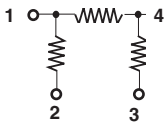
T



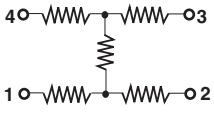
U



O
(BALANCED Pi)



H
(BALANCED T)



For technical questions, contact: sfer@vishay.com
Document Number: 52018
Revision: 01-Oct-09

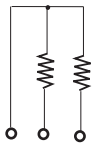
PACKAGED CONFIGURATIONS

Standard models - consult Vishay Sfernice for special configuration requirements

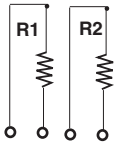
2 RESISTOR NETWORKS

MR32S

MR32P

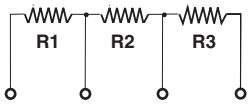


MR42E

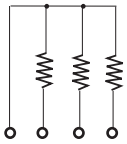


3 RESISTOR NETWORKS

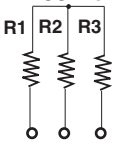
MR43S or U



MR43P

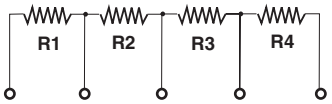


MR33P or T

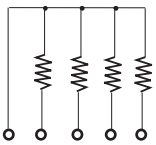


4 RESISTOR NETWORKS

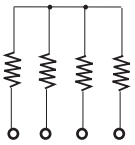
MR54S



MR54P

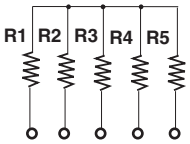


MR44P



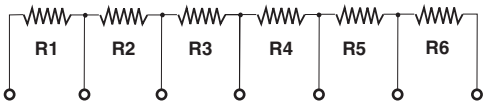
5 RESISTOR NETWORKS

MR55P

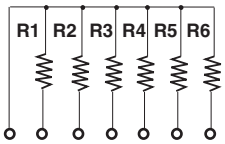


6 RESISTOR NETWORKS

MR76S

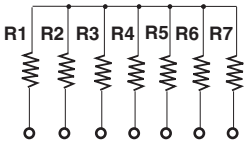


MR76P



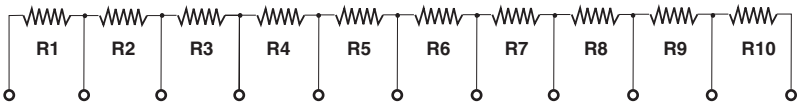
7 RESISTOR NETWORKS

MR77P

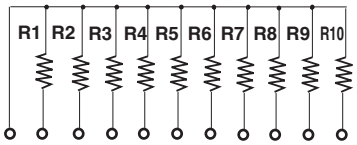


10 RESISTOR NETWORKS

MR1110S

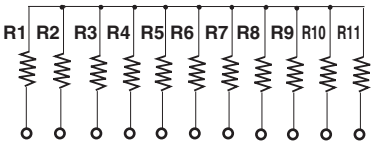


MR1110P



11 RESISTOR NETWORKS

MR1111P



ORDERING INFORMATION

ATTENUATORS

MR	3	3	T	S	20B	50U	1 %	K3	e2
	NUMBER OF LEADS	NUMBER OF RESISTORS	CONFIGURATION	LEAD SPACING	ATTENUATION RANGE	IMPEDANCE	TOLERANCE PER RESISTIVE ELEMENT	TEMPERATURE COEFFICIENT	LEAD (Pb)-FREE

S STANDARD: 2.54 (0.100)
A ON REQUEST: 5.08 (0.200)

RESISTOR NETWORKS

MRC	9	8	P	S	50U	XXX	e2
MODEL	NUMBER OF LEADS	NUMBER OF RESISTORS	CONFIGURATION	LEAD SPACING	APPLICABLE	SPECIAL REQUEST, TRACKING MATCHING	LEAD (Pb)-FREE
		P = Parallel S = Serie		S standard: 2.54 (0.100) A on request: 5.08 (0.200)	Only when the ohmic value is the same for all resistors		

SAP PART NUMBERING GUIDELINES

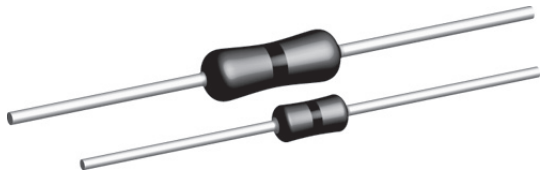
ATTENUATORS

M	33	T	S	500	2R0	F	H
MODEL	SIZE	CONFIGURATION	LEAD SPACING	IMPEDANCE	ATTENUATORS	TOLERANCE	TEMPERATURE COEFFICIENT

RESISTOR NETWORKS

MRC	98	P	S	500	XXX
MODEL	SIZE	CONFIGURATION	LEAD SPACING	OHMIC VALUE	SPECIAL REQUEST

Zero-Ohm Strap Resistors



FEATURES

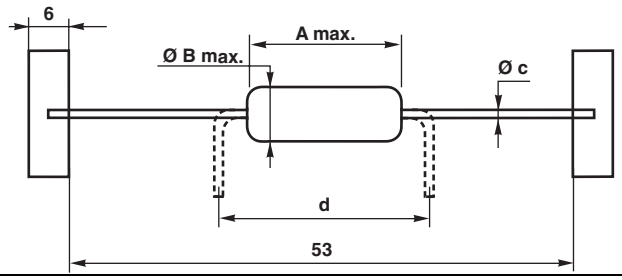
- Resistive element made with high stability film allowing low end resistance and high current through resistance
- Color band marking for ease of identification after mounting
- Compatible with automatic insertion equipment
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

APPLICATIONS

- Electronic circuits for any usage

DIMENSIONS in millimeters



SERIES	A max.	Ø B max.	Ø c	d
SL3	3.9	1.8	0.5	5.08
SL4	6.2	2.5	0.6	7.62

MECHANICAL SPECIFICATIONS

	SL4	SL3
Max. ohmic value	10 mΩ	15 mΩ
Max. current through resistor	3 A	2 A
Insulation voltage	> 500 V_{CC}	> 500 V_{CC}
Insulation resistance	≥ 10^5 MΩ	≥ 10^5 MΩ
Max. unit weight	0.25 g	0.15 g

IDENTIFICATION

Brown body with a black ring in the middle.

PACKAGING

REEL OF 5000 PIECES: CODE B0 5000
"AMMOPACK" BOX OF 1000 PIECES: CODE AM 1000
REEL PACKAGING AS PER CEI 286 AND EIA 296D SPECIFICATIONS

ORDERING INFORMATION

SL	4	0U	AM 1000	e3
SERIES	VERSION	OHMIC VALUE	PACKAGING	LEAD (Pb)-FREE

GLOBAL PART NUMBER INFORMATION

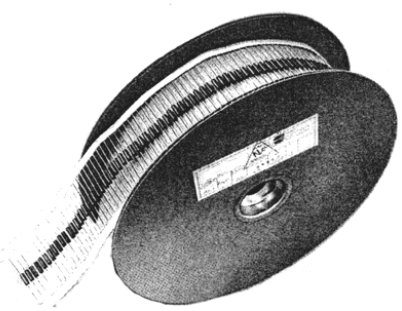
S	L	4	R	0	0	A	2	2

GLOBAL MODEL	SIZE	OHMIC VALUE	PACKAGING
SL	**3** **4**	R designates decimal point. **R00** = 0 Ω	AM1000 = **A22** TR5000 = **R26**

General Information

Contents

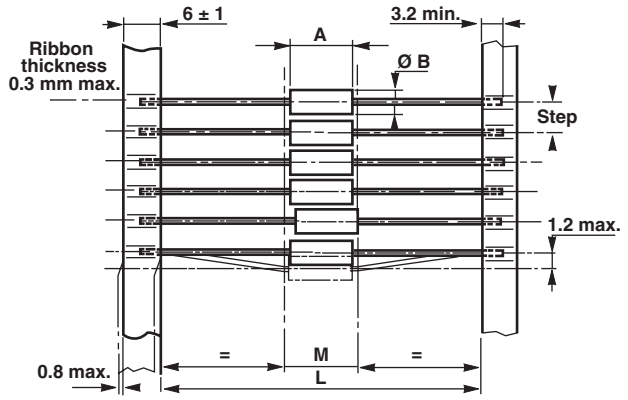
Tape and Reel Packaging for Automatic Insertion, Metal Film Resistors

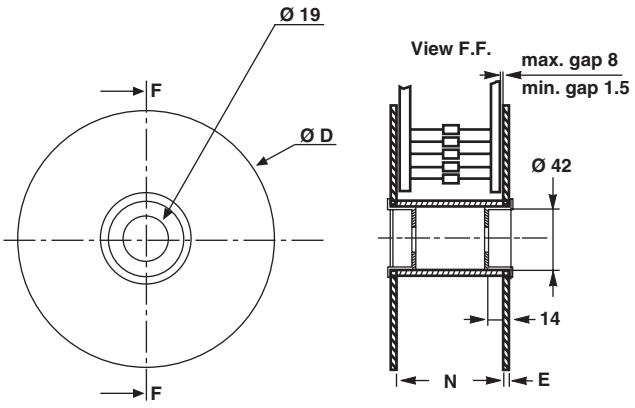


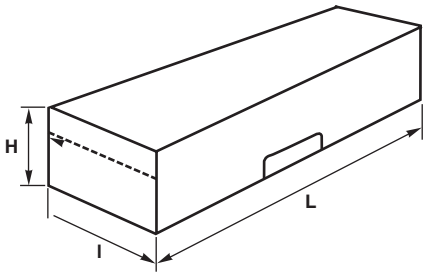
FEATURES

- CEI 286-1
- NFC 90-520
- ETA standard RS 296D

DIMENSIONS in millimeters







DIMENSIONS in millimeters					
SERIES AND STYLE	**Ø B**	**A**	**M**	**STEP ± 0.3**	**L ± 1.5**
RCM...02	2.5	6.7	A + 1.4	5	53
RCM...05	3.75	10.4	A + 1.4	5	53
RCM...08-1 (2)	6.44	16.5	A + 1.4	10	73 (1)

Notes

(1) Non standard

(2) Concerns RCMM1, RCMS1, RCMX1, RCMA08, RCMT08 Consult Vishay Sfernice for RCMA1 and RCMT1

TAPE PACKAGING IN AMMOPACK				
SERIES	**DIMENSIONS**			**QUANTITY OF PIECES**
	I	**L**	**H**	
RCM...02	80	260	37	1000
RCM...02/05	80	260	37	500

PACKAGING CHARACTERISTICS

- Tolerance on quantity: ± 1 %
- Number of empty spaces on tape: < 0.25 %
- Two empty spaces running maximum followed by 6 components are tolerated
- Tolerance on 10 steps: ± 1 mm
- The thickness of the ribbon can be 4 times the usual ribbon thickness, that is 1.2 mm maximum.
- Components resistance to pull action: ≥ 5 N, ribbons tensile strength: ≥ 50 N (axial strength)
- When tape and reel packaging, a protecting sheet of paper is placed in-between the component layers

MARKING

On a label: Vishay Sfernice trademark, series, style, ohmic value (in Ω), tolerance (in %), quantity of pieces, manufacturing date. On all models undergoing the centralized quality control: CCQ and N° stamp.

Fixed Resistors Packaging

Series \ Minimum quantity per	Tape and Reel		Bag	Other
	Reel	Ammo-pack		
MSP			only Techno B	Tube
MSP1	500	-	x 100	70
MSP2	500	-	x 100	50
MSP3 only Techno B	-	-	x 100	40
RTO				Tube
RTO20 - RTO50	-	-	-	50
RCH				
RCH 5	-	-	25	-
RCH 10	-	-	25	-
RCH 25	-	-	25	-
RCH 50	-	-	25	-
RPH				Box
RPH 100	-	-	-	5
RTOP				Box
RTOP 200	-	-	-	10
RTOP 100	-	-	-	10
DRTOP 100	-	-	-	10
DRTOP 50	-	-	-	10
TRTOP 40	-	-	-	10
TRTOP 30	-	-	-	10
QRTOP 35	-	-	-	10
QRTOP 20	-	-	-	10
RPS				Box
RPS 250 - 500	-	-	-	15
RWM				Box
RWM 4 x 10	1000	500	-	-
RWM 4 x 22	1000	500	-	-
RWM 5 x 26	1000	250	-	-
RWM 6 x 22	1000	250	-	-
RWM 8 x 26	1000	250	-	-
RWM 6 x 34	-	-	50	-
RWM 8 x 34	-	-	50	-
RWM 8 x 45	-	-	-	50
RWM 10 x 45	-	-	-	50
RWM 10 x 64	-	-	-	50
RWM 10 x 65	-	-	-	50
RLP				
RLP 1	1000	500	100	-
RLP 2	1000	500	100	-
RLP 3	1000	500	-	20 Blister
RLP 6	-	-	-	50 Box
RLP 10	-	-	-	50 Box
RMB				
RMB 0.75	1000	500	100	-
RMB 1.5	1000	500	100	-
RMB 3	1000	500	50	-
RMBS				
RMBS 05	1000	500	100	-
RMBS 1	1000	500	100	-
RMBS 2	1000	500	50	-
BSI				Box
58 BSI	5000	2000	-	-
63 BSI	3000	1000	-	-
68 BSI	1250	400	-	-
516 BSI	1250	400	-	-
523 BSI	1250	400	-	-
923 BSI	500	250	-	-
932 BSI	-	-	-	30
947 BSI	-	-	-	30

Series \ Minimum quantity per	Tape and Reel		Bag	Other
	Reel	Ammo-pack		
SG				Case
SG3	1500	-	-	-
SG4	1250	-	-	-
RH - SH				
RH 5 - SH 5	-	-	10	-
RH 10 - SH 10	-	-	10	-
RH 25 - SH 25	-	-	10	-
RH 50 - SH 50	-	-	10	-

Series \ Minimum quantity per	Bag or Box	Box collars		
		AN and faston	B	CS
RW				
RW 8 x 34	25	-	-	-
RW 10 x 50	25	-	-	-
RW 13 x 70	-	40	50	50
RW 16 x 94	-	30	30	-
RW 20 x 117	-	20	20	-
RWST 25 x 138	-	6	6	4
RWST 25 x 168	-	6	6	4
RWST 30 x 250	-	6	6	4
RWST 40 x 370	-	2	-	2
RWST 50 x 373	-	1	-	1
RSO				
RSO 25 x 138	-	3/6	-	2/4
RSO 25 x 168	-	3/6	-	2/4
RSO 30 x 250	-	3/6*	-	2/4*
RSO 40 x 370	-	1	-	1
RSO 50 x 373	-	1	-	1
RSSD				
RSSD 8 x 34	50	-	-	-
RSSD 10 x 50	25	-	-	-
RSSD 13 x 70	-	30	-	-
RSSD 16 x 94	-	30	-	-
RSSD 20 x 117	-	20	-	-
RSSD 25 x 138	-	6	-	4
RSSD 25 x 168	-	6	-	4
RSSD 30 x 250	-	6	-	4
RSSD 40 x 370	-	2	-	2
RSSD 60 x 373	-	1	-	1
RT	Box	Box		
RT 12	1	10		
RT 25	1	10		
RT 55	1	-		
RT 100	1	-		
RT 230	1	-		
RT 500	1	-		
RA				
RA 13 x 70		10	10	-
RA 16 x 94		10	10	-
RA 20 x 117		10	10	-
RA 25 x 138		4	4	-
RA 25 x 168		4	4	-
RA 30 x 250		3	3	-

Note

* depend of ohmic value

Series	Type	Packaging		
		Bag	Ammo-pack	Tape and Reel
NK	3 (5 % and 2 %)	-	1000	-
	3CC	500	-	-
	4	-	1000	5000
	N4	-	1000	5000
	5	-	500	-
	N5	-	500	-
NP	3S	100	500	-
	4S	100	500	5000
	5S	100	500	-
NT	3S	100	500	-
	3CC	100	-	-
	4S	100	500	5000
	5S	100	500	-
NY	3	-	500	-
	3CC	500	-	-
	4	-	500	5000
	5	-	500	-
SL	3	-	1000	5000
	4	-	1000	5000
RCMM	02	100	500	1000
	05	100	500	-
	1	500	500	-
RCMS	02	100	500	1000
	05	100	500	-
	1	500	500	-
RCMX	02	100	500	1000
	05	100	500	-
	1	500	500	-
RCMA	02	10/100	500	-
	05	10/100	500	-
	08	10/50	-	-
	1	10/50	-	-
	2	50	-	-
	4	50	-	-
RCME	Tous types	10/100	500	-
RCMT	01	10/100	-	-
	02	10/100	500	-
	05	10/100	500	-
	08	10/50	-	-
	1	10/50	-	-
	2	50	-	-
	4	50	-	-

Series	Type	Packaging			
		Blister	Ammo-pack	Box	Tape and Reel
HTS	58/63	25	500	-	-
	68	20	500	-	-
	932/947	-	-	30	-
	523/547	-	-	30	-
	972/9100	-	-	40	-
	729/747	-	-	40	-
HPS	58/63	20	500	-	-
	68	20	400	-	-
	523	-	-	30	500
	923/932/947	-	-	30	-

Series	Type	Packaging
		Tube
LTO	30	50
	50	50
	100	30

Metal Film Resistors

RCMM - RCMS - RCMX - RCMA - RCMT - RCME are print marked. Available room for marking is in relation to size.

- The table below indicates the order in which markings appear.
- Generally, the temperature coefficient is coded K2 for ± 100 ppm, K3 for ± 50 ppm; K4 for ± 25 ppm, K5 for ± 15 ppm.
- The ± sign for tolerance on ohmic value is not marked, and the tolerance is clearly indicated with a decimal point (e.g. 0.5 %) except size 02.
- The manufacturing date code is as follows:
  1 letter only for month and year for size 02; 1 letter for the year and 1 numeral for the month for all other sizes.

RCMM

02	05	1
MM02 K/tol./date VΩ	Sfernice CT RCMM 05 VΩ tol./date	Sfernice RCMM 1/CT VΩ tol./date

RCMS

	02	05	1	
			Qualified	Other
K3 **± 50 ppm/°C**	MS02 Y/tol./date VΩ	Sfernice CT RCMS 05 VΩ tol./date	Sfernice RCMS 1/CT VΩ/tol. date RS68Y	Sfernice RCMS 1/CT VΩ tol./date

RCMX

	02	05	1
K3 **± 50 ppm/°C**	MX 02 Y/tol./date VΩ	Sfernice/CT RCMX 05 VΩ tol./date	Sfernice RCMX 1/CT VΩ % date

RCMA

	Other	02	05		08 - 1 - 2 - 4
			Other	Qualified	
K3 **± 50 ppm/°C**	MA 02 Y/tol./date VΩ				
		Qualified			
K4 **± 25 ppm/°C**	MA 02 P/tol./date VΩ	RS 58 P/tol./date VΩ	Sfernice/CT RCMA 05 VΩ tol./date	Sfernice K4 RS 63P VΩ tol./date	Sfernice/CT RCMA... VΩ tol./date
K5 **± 15 ppm/°C**	MA02 tol./K5 VΩ				

Marking Specifications

Vishay Sfernice — Metal Film Resistors

RCMT

	02		05	08	1	2 4
	Other	Qualified	Qualified	Qualified	Qualified	
K3 ± 50 ppm/°C	MT 02 C/tol./date VΩ	RS 56 C/tol./date VΩ	Sfernice K3 RS 60C VΩ tol./date	Sfernice K3 RCMT 08/date VΩ tol./RS 65C	Sfernice K3 RCMT 1/date VΩ tol./RS 70C	
K4 ± 25 ppm/°C	MT 02 E/tol./date VΩ	RS 56 E/tol./date VΩ	Sfernice K4 RS 60E VΩ tol./date	Sfernice K4 RCMT 08/date VΩ tol./RS 65E	Sfernice K4 RCMT 1/date VΩ tol./RS 70E	Sfernice CT RCMT VΩ tol./date
			Other	Other	Other	
K5 ± 15 ppm/°C	MT 02 tol./K5 VΩ		Sfernice CT RCMT 05 VΩ tol./date	Sfernice CT RCMT 08 VΩ tol./date	Sfernice CT RCMT 1 VΩ tol./date	

RCME

02	05
//date ME 02 tol./CT VΩ	//date ME 05 tol./CT VΩ

MANUFACTURING DATE IDENTIFICATION

Size 02

The manufacturing date code is as follows:
1 letter only for month and year.

MONTH / YEAR	J	F	M	A	M	J	J	A	S	O	N	D
2009	T	U	V	W	X	Y	Z	A	B	C	D	E
2010	F	G	H	J	K	L	M	N	P	Q	R	S
2011	T	U	V	W	X	Y	Z	A	B	C	D	E
2013	F	G	H	J	K	L	M	N	P	Q	R	S

Sizes 05 - 08 - 1 - 2 - 4

The manufacturing date code is 1 letter for the year and 1 numeral for the month:
1 January, 2 February ... 9 September, O October, N November, D December.

2009 X	2010 A	2011 B	2012 C	2013 D	2014 E	2015 F	2016 H	2017 J
2018 K	2019 L	2020 M	2021 N	2022 P	2023 R	2024 S	2025 T	2026 U

TCR MARKING

RCMM - RCMS - RCMX - RCMA - Style 02

K = ± 100 ppm/°C
Y = ± 50 ppm/°C
P = ± 25 ppm/°C

RCMT 02

C = ± 50 ppm/°C
E = ± 25 ppm/°C

For technical questions, contact: sfer@vishay.com

Document Number: 52021
Revision: 29-Jul-09

Standard Ohmic Values

E192	E96	E48	E24	E12	E6	E3
± 0.5 %	± 1 %	± 2 %	± 5 %	± 10 %	± 20 %	-
100	100	100	100	100	100	100
101						
102	102					
104						
105	105	105				
106						
107	107					
109						
110	110	110	110			
111						
113	113					
114						
115	115	115				
117						
118	118					
120			120	120		
121	121	121				
123						
124	124					
126						
127	127	127				
129						
130	130		130			
132						
133	133	133				
135						
137	137					
138						
140	140	140				
142						
143	143					
145						
147	147	147				
149						
150	150		150	150	150	
152						
154	154	154				
156						
158	158					
160			160			
162	162	162				
164						
165	165					
167						
169	169	169				
172						
174	174					
176						

E192	E96	E48	E24	E12	E6	E3
± 0.5 %	± 1 %	± 2 %	± 5 %	± 10 %	± 20 %	-
178	178	178	140	150	150	100
180			180	180		
182	182		180			
184						
187	187	187				
189						
191	191					
193						
196	196	196				
198						
200	200		200			
203						
205	205	205				
208						
210	210					
213						
215	215	215				
218						
221	221		220	220	220	220
223						
226	226	226				
229						
232	232					
234						
237	237	237				
240			240			
243	243					
246						
249	249	249				
252						
255	255					
258						
261	261	261				
264						
267	267					
271			270	270		
274	274	274				
277						
280	280					
284						
287	287	287				
291						
294	294					
298						
301	301	301	300			
305						
309	309					
312						

Standard Ohmic Values

Vishay Sfernice

Standard Ohmic Values

E192	E96	E48	E24	E12	E6	E3
± 0.5 %	± 1 %	± 2 %	± 5 %	± 10 %	± 20 %	-
316	316	316	300	270	220	220
320						
324	324					
328			330	330	330	
332	332	332				
336						
340	340					
344						
348	348	348				
352						
357	357		360			
361						
365	365	365				
370						
374	374					
379						
383	383	383				
388						
392	392		390	390		
397						
402	402	402				
407						
412	412					
417						
422	422	422				
427						
432	432		430			
437						
442	442	442				
448						
453	453					
459						
464	464	464				
470			470	470	470	470
475	475					
481						
487	487	487				
493						
499	499					
505						
511	511	511	510			
517						
523	523					
530						
536	536	536				
542						
549	549					
556						

E192	E96	E48	E24	E12	E6	E3
± 0.5 %	± 1 %	± 2 %	± 5 %	± 10 %	± 20 %	-
562	562	562	560	560	470	470
569						
576	576					
583						
590	590	590				
597						
604	604					
612						
619	619	619				
626			620			
634	634					
642						
649	649	649				
657						
665	665					
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681	681	681	680	680	680	
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698	698					
706						
715	715	715				
723						
732	732					
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750	750	750	750			
759						
768	768					
777						
787	787	787				
796						
806	806					
816						
825	825	825	820	820		
835						
845	845					
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866	866	866				
876						
887	887					
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909	909	909	910			
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931	931					
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For technical questions, contact: sfer@vishay.com

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WORLDWIDE SALES CONTACTS

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THE AMERICAS

UNITED STATES

VISHAY AMERICAS
ONE GREENWICH PLACE
SHELTON, CT 06484
UNITED STATES
PH: +1-402-563-6866
FAX: +1-402-563-6296

ASIA

SINGAPORE

VISHAY INTERTECHNOLOGY
ASIA PTE LTD.
37A TAMPINES STREET 92 #07-00
SINGAPORE 528886
PH: +65-6788-6668
FAX: +65-6788-0988

P.R. CHINA

VISHAY TRADING (SHANGHAI) CO., LTD.
15D, SUN TONG INFOPORT PLAZA
55 HUAI HAI WEST ROAD
SHANGHAI 200030
P.R. CHINA
PH: +86-21-5258-5000
FAX: +86-21-5258-7979

JAPAN

VISHAY JAPAN CO., LTD.
MG IKENOHATA BLDG. 4F
1-2-18, IKENOHATA
TAITO-KU
TOKYO 110-0008
JAPAN
PH: +81-3-5832-6210
FAX: +81-3-5832-6260

EUROPE

GERMANY

VISHAY ELECTRONIC GMBH
GEHEIMRAT-ROSENTHAL-STR. 100
95100 SELB
GERMANY
PH: +49-9287-71-0
FAX: +49-9287-70435

FRANCE

VISHAY S.A.
199, BLVD DE LA MADELEINE
06003 NICE, CEDEX 1
FRANCE
PH: +33-4-9337-2727
FAX: +33-4-9337-2726

UNITED KINGDOM

VISHAY LTD.
SUITE 6C, TOWER HOUSE
ST. CATHERINE'S COURT
SUNDERLAND ENTERPRISE PARK
SUNDERLAND SR5 3XJ
UNITED KINGDOM
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