FrelTec GmbH

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82319 Starnberg
Germany

Metal Oxide Film Resistor

Metal Oxide Film Resistors

SPECIFICATION

Part Number

053		012*		N*		_ _ _ _		J*		TB*		1*		_*		_*
Type		Power Rating		Body Size		Value		Tolerance		Packing Type		Packing quantity		Option 1		Option 2
		Code : Watt														
053 : Metal Oxide Film Resistor		025 : ,25(1/4 W)		N:Normal size		The last digit is the		G : ±2%		TR : Tape in Reel		F : 8 pc		0 = PT-52mm		I : Non-Inductive product)
		050 : 0,50(1/2W)		S:Small Size)		multiplier which denotes		J : ±5%		TB : Tape in Box		G : 10 pc		8 = PT-58mm		
		100 : 1,0 (1 W)		U : Ultra small size		the number of zero following		K :±10%		BP : Bulk Packing		H : 32 pc		9 = PT-64mm		
		200 : 2,0 (2 W)				0000 = 0Ohm				TP : Tape in Box of PT-26mm		I : 50 pc		7 = Lead wire (h) 38mm		
		300 : 3,0 (3 W)				R = Decimal						W : 100 pc		A = PT-83mm		
		400 : 4,0 (4 W)				Example: R010 = 0,01Ohm						Y : 300 pc		C = PT-73mm		
		500 : 5,0 (5 W)				97R6=						Z : 400 pc		D = PT-71mm		
		700 : 7,0 (7 W)				9760 = 976Ohm						A : 500 pc		P = Panasert type		* not all combination is possible
		800 : 8,0 (8 W)				1001 = 1kOhm						1 : 1k pc				
		900 : 9,0 (9 W)										2 : 2k pc				
												B : 2.500 pc				
												3 : 3k pc				
												4 : 4k pc				
												5 : 5k pc				

Example:

Part Number	**Description**
053025N1000GTR1:	Metal Oxide Film Fixed Resistor, 1/4W, Normal Size, 100Ω, +/-2% tolerance, Tape in Reel, 1kpc

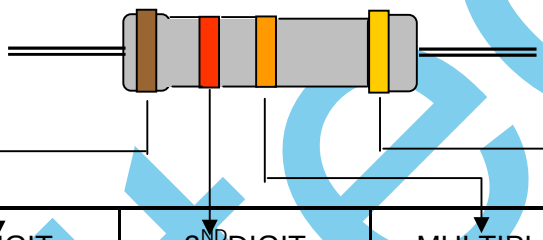
Metal Oxide Film Resistors

1. **Applicable Scope**:

This specification is for use in METAL OXIDE FILM FIXED RESISTORS
Characteristics and specifications are according to those of:
JIS C 5202

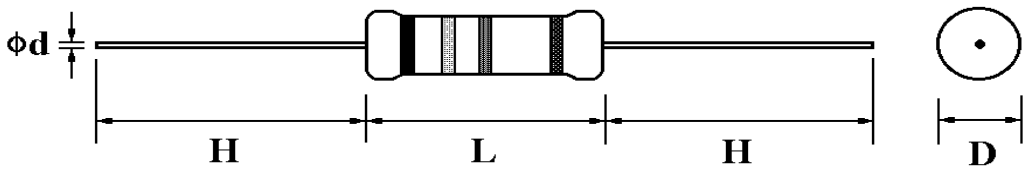
2. Marking

Colour code indication for nominal resistance value and tolerance
Fixed resistors of which the nominal resistance value and tolerance are indicated by colour codes in accordance with JIS C 0802, following the standard as below:



COLOR	1ST DIGIT	2ND DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	0	1	
BROWN	1	1	10	
RED	2	2	100	G(±2%)
ORANGE	3	3	1.000	
YELLOW	4	4	10.000	
GREEN	5	5	100.000	
BLUE	6	6	1.000.000	
VIOLET	7	7	10.000.000	
GREY	8	8		
WHITE	9	9		
GOLD			0,1	J (±5%)
SILVER			0,01	K (±10%)

3. DIMENSIONS:

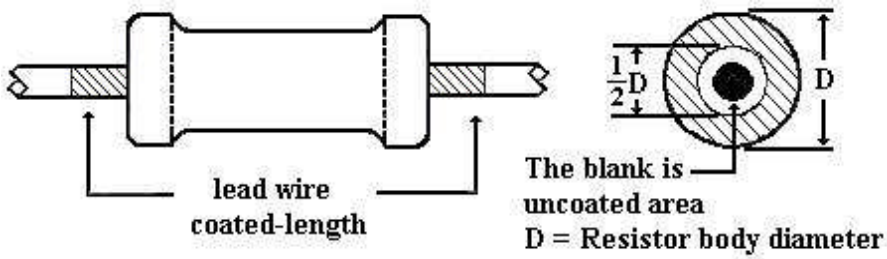


Normal size (not for Non-Flame and not for Non Inductive)					
Part No.	Power Rating at 70 ℃	Dimension (mm)			
		D (Max.)	L (Max.)	d ± 0.05	H ± 3
053 025 N	1/4W (0,25W)	2,5	7,5	0,54	28
053 050 N	1/2W (0,50W)	3,5	10,0	0,54	28
053 100 N	1W	5,0	12,0	0,70	25
053 200 N	2W	5,5	16,0	0,70	28
053 300 N	3W	6,5	17,5	0,75	28
053 500 N	5W	8,5	26,0	0,75	38
053 700 N	7W	8,5	32,0	0,75	38
053 800 N	8W	8,5	41,0	0,75	38
053 900 N	9W	8,5	54,0	0,75	38

Small size (not for Non-Flame and not for Non Inductive)					
Part No.	Power Rating at 70 ℃	Dimension (mm)			
		D (Max.)	L (Max.)	d ± 0.05	H ± 3
053 050 S	1/2W (0,50W)	2,5	7,5	0,54	28
053 100 S	1W	3,5	10,0	0,54	28
053 200 S	2W	5,0	12,0	0,70	25
053 300 S	3W	5,5	16,0	0,70	28
053 400 S	4W	6,5	17,5	0,75	28
053 500 U	5W	6,5	17,5	0,75	28
053 500 S	5W	8	25	0,75	38

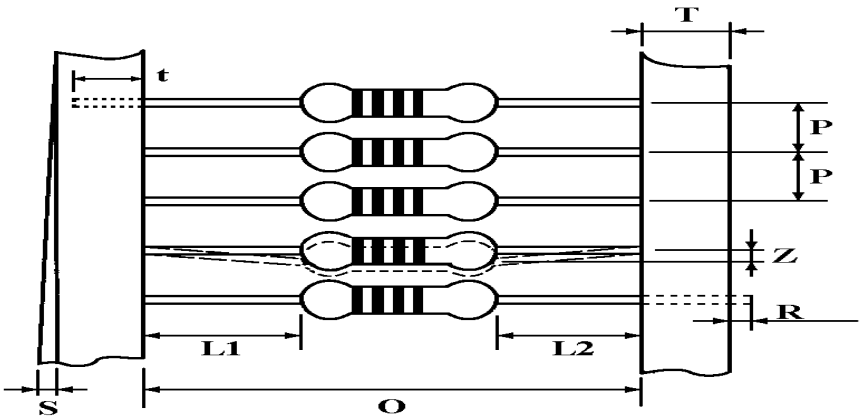
4. Painting method:

Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover. The extent should be within 1/2 of the angle.



5. Packing

Tape Packing



Normal size									
Part No.	Style	O	P	L1-L2	T	Z	R	T	S
053 025 N	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 050 N	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 100 N	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 200 N	PT-64	64 ± 1	10 ± 0,5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0,5 Max.
053 300 N	PT-64	64 ± 1	10 ± 0,5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0,5 Max.

Small size									
Part No.	Style	O	P	L1-L2	T	Z	R	T	S
053 050 S	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 100 S	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 200 S	PT-52	52 ± 1	5 ± 0,3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0,5 Max.
053 300 S	PT-64	64 ± 1	10 ± 0,5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0,5 Max.
053 400 S	PT-64	64 ± 1	10 ± 0,5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0,5 Max.
053 500 U	PT-64	64 ± 1	10 ± 0,5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0,5 Max.

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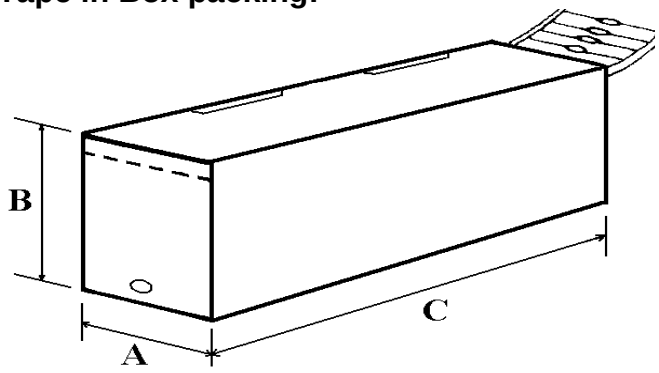
Tape in Box packing:



Bandoliers may also be contained in a cardboard box ("Ammopack")

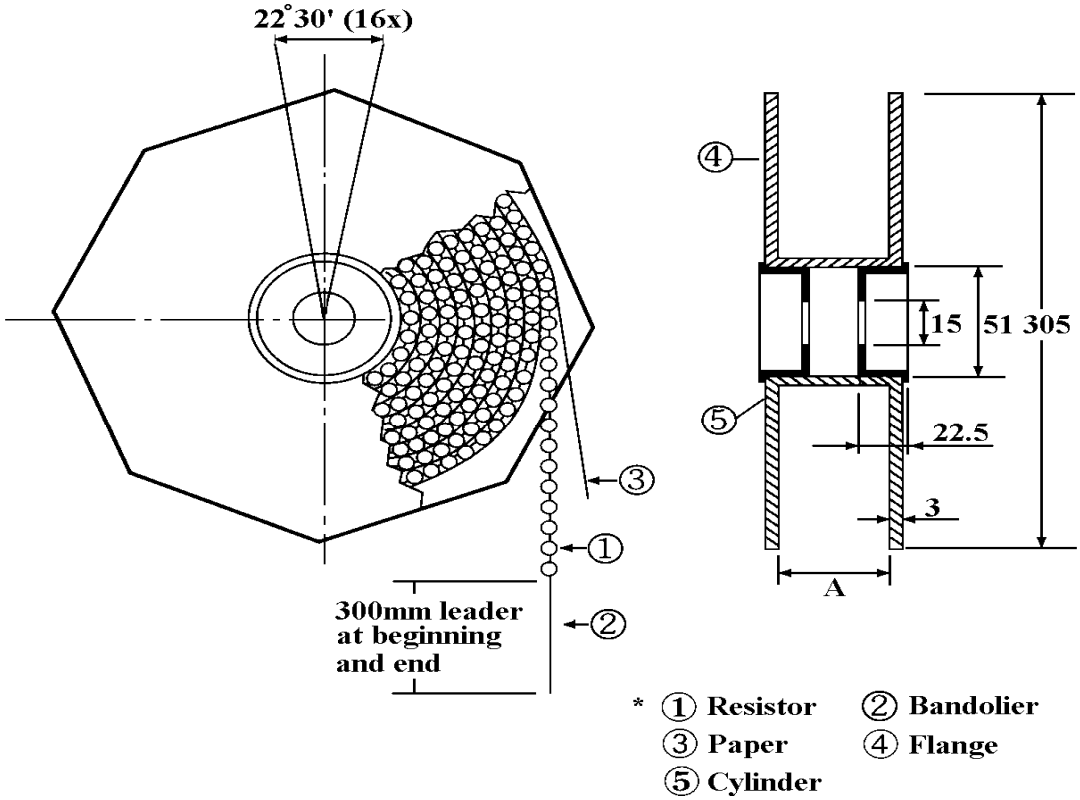
Normal size					
Part No.	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
053 025 N	PT-52	250	75	96	5.000
053 050 N	PT-52	260	85	70	1.000
053 100 N	PT-52	262	86	80	1.000
053 200 N	PT-64	262	92	108	1.000
053 300 N	PT-64	256	92	80	500

Small size					
Part No.	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
053 050 S	PT-52	250	75	96	5.000
053 100 S	PT-52	260	85	70	1.000
053 200 S	PT-52	262	86	80	1.000
053 300 S	PT-64	262	92	108	1.000
053 400 S	PT-64	256	92	80	500
053 500 U	PT-64	256	92	80	500

"Ammopack" is an abbreviation of "ammunition pack"

Metal Oxide Film Resistors

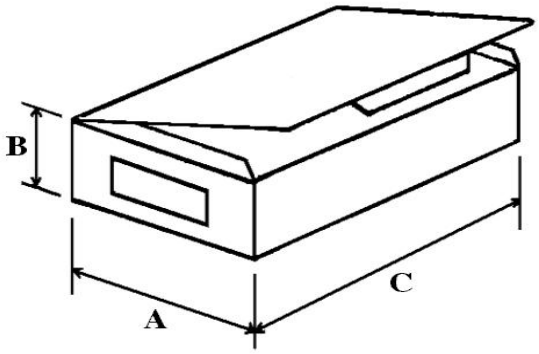
Tape in Reel packing:



Normal size			
Part No.	Style	Across Flange (A)	Quantity Per Reel
053 025 N	PT-52	73 ± 2	5.000
053 050 N	PT-52	73 ± 2	2.500
053 100 N	PT-52	73 ± 2	2.500
053 200 N	PT-64	81 ± 5	1.000
053 300 N	PT-64	81 ± 5	500

Small size			
Part No.	Style	Across Flange (A)	Quantity Per Reel
053 050 S	PT-52	73 ± 2	5.000
053 100 S	PT-52	73 ± 2	2.500
053 200 S	PT-52	73 ± 2	2.500
053 300 S	PT-64	81 ± 5	1.000
053 400 S	PT-64	81 ± 5	500
053 500 U	PT-64	81 ± 5	500

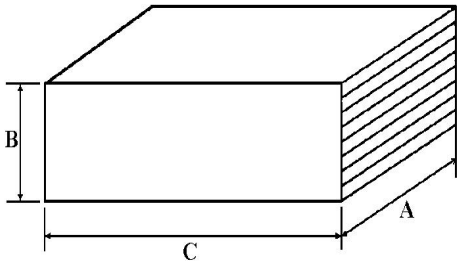
Bulk in box packing:
(plastic bag)



Normal size				
Part No.	L(C) ± 5	W(A) ± 5	H(B) ± 5	Quantity Per Bag (Pcs.)
053 025 N	150	77	33	500 / 1.000
053 050 N	155	95	53	100 / 1.000
053 100 N	155	95	53	100 / 500
053 200 N	155	95	53	100 / 500
053 300 N	155	95	53	100 / 400
053 500 N	210	130	56	50 / 200
053 700 N	150	75	33	8 / 32
053 800 N	150	75	33	8 / 32
053 900 N	200	171	113	10 / 300

Small size				
	L(C) ± 5	W(A) ± 5	H(B) ± 5	Quantity Per Bag (Pcs.)
053 050 S	150	77	33	500 / 1.000
053 100 S	155	95	53	100 / 1.000
053 200 S	155	95	53	100 / 500
053 300 S	155	95	53	100 / 500
053 400 S	155	95	53	100 / 400
053 500 U	155	95	53	100 / 400
053 500 S	155	95	53	100 / 200

Bulk in plastic case packing:



Part No.	L(C) ± 5	W(A) ± 5	H(B) ± 5	Quantity Per Bag (Pcs.)
053 550 N	360	200	85	100 / 1.000
053 500 S	360	200	85	100 / 1.000

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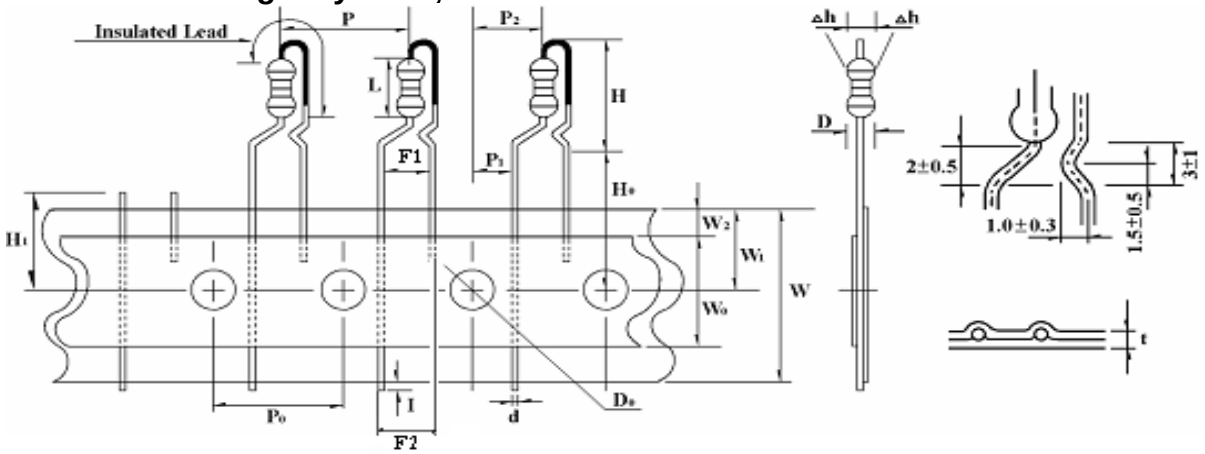
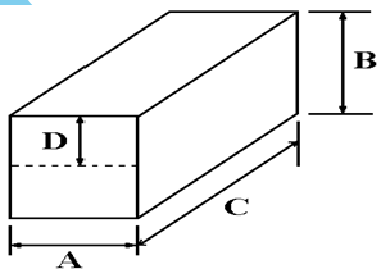
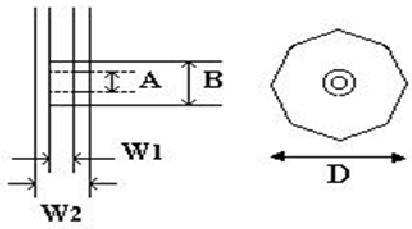
Panasert-Forming only 1/4W, 1/2W-S:



Items	Symbol	Dimension (mm)	Items	Symbol	Dimension (mm)
Body diameter	D	2,5 Max,	Tape width	W	18 ± 1
Body length	L	6,8 Max,	Hold down tape width	W_0	12,5 Min
Body height	H	12 Max,	Hole position	W_1	9 ± 0,5
Lead wire diameter	d	0,54 +/-0,05	Hold down tape position	W_2	3,0 Max
Pitch of component	P	12,7 ± 1	Lead wire clinch height	H_0	16,5 Max
Feed hold pitch	P_0	12,7 ± 0,3	Length of snipped lead	H_1	11,0 Max
Hole center to lead	P_1	3,85 ± 0,7	Lead wire protrusion	I	1,0 Max
Hole center to body		6,35 ± 1,3	Feed hole diameter	D_0	4,0 ± 0,3
Lead to lead spacing	F1	4,19 Min	Total tape thickness	t	0,5 ± 0,2
	F2	6,22 Max	Length of lead cut	H_1 - H_2	2 ± 0,5
Component alignment	Δh	0 ± 1			
Remark: P_0 Cumulative pitch error 1 mm / 20 pitch.					

Size and Type	Ammo packing		Reel packing	
Figure				
Dimension	A	50 mm.	A	30 mm.
	B	150 mm.	B	50 mm.
	C	330 mm.	D	370 mm.
	D	50 mm.	W_1	41 mm.
			W_2	45 mm.
Quantity	2.000 pcs.		2.500 pcs.	

Ordering number example: 053025N110kFTRBP
Metal Oxide Film resistor 1/4W, 110kOhm, 1% Tape in Reel, 2.5kpc
Panasert-Forming

Metal Oxide Film Resistors

6. Specification

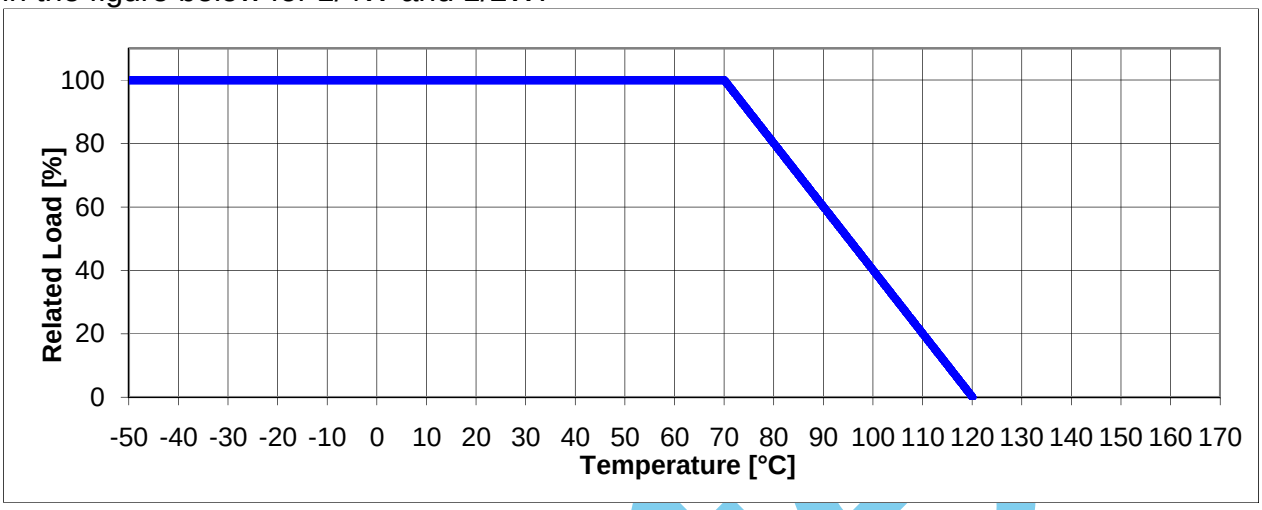
Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Tolerance %	T.C.R (PPM/°C)	Resistance Range	Operating Temp. Range
053 025 N	1/4W (0,25W)	250 V	400 V	250 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 050 N	1/2W (0,50W)	250 V	400 V	250 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 100 N	1W	350 V	600 V	350 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 200 N	2W	350 V	600 V	350 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 300 N	3W	500 V	800 V	500 V	± 10		5Ω-100kΩ	
					± 5	± 350	5Ω-100kΩ	-55℃ -- +155℃
					± 2		5Ω-100kΩ	
053 500 N	5W	750 V	1.000 V	750 V	± 10		5Ω-150kΩ	
					± 5		5Ω-150kΩ	
					± 2		5Ω-150kΩ	
053 700 N	7W	750 V	1.000 V	750 V	± 10		20Ω-150kΩ	
					± 5		20Ω-150kΩ	
					± 2		20Ω-150kΩ	
053 800 N	8W	750 V	1.000 V	750 V	± 10		30Ω-200kΩ	
					± 5		30Ω-200kΩ	
					± 2		30Ω-200kΩ	
053 900 N	9W	750 V	1.000 V	750 V	± 10		50Ω-200kΩ	
					± 5		50Ω-200kΩ	
					± 2		50Ω-200kΩ	

Metal Oxide Film Resistors

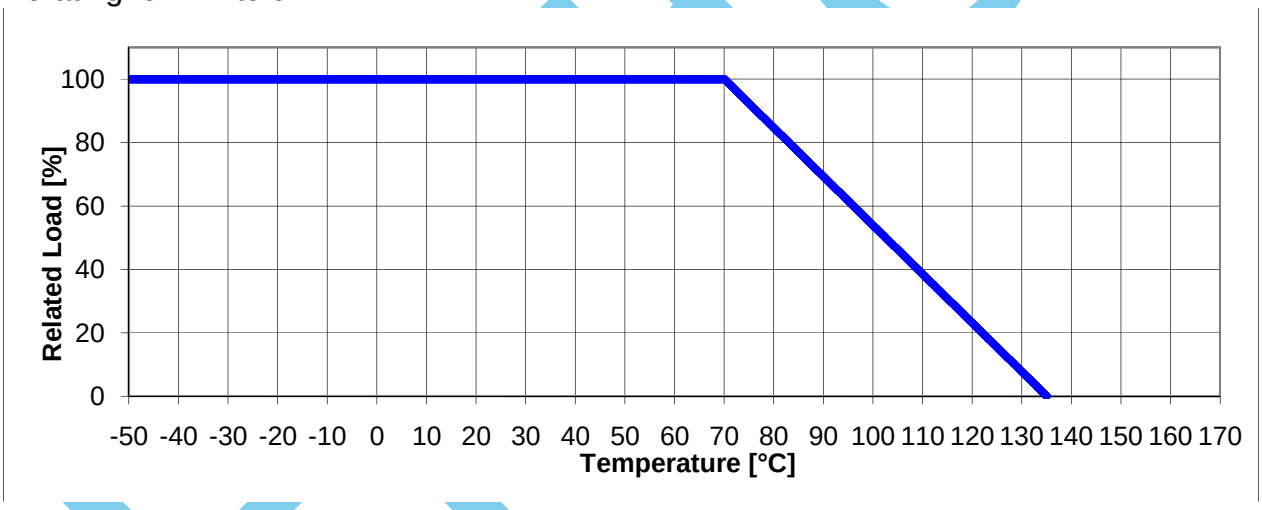
Type	Rated Power at 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Tolerance %	T.C.R (PPM/°C)	Resistance Range	Operating Temp. Range
053 050 S	1/2W (0,50W)	250 V	400 V	250 V	± 10	± 350	0,3Ω-50kΩ	-55°C -- +155°C
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 100 S	1W	350 V	600 V	350 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 200 S	2W	350 V	600 V	350 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 300 S	3W	350 V	600 V	350 V	± 10		0,3Ω-50kΩ	
					± 5		0,3Ω-50kΩ	
					± 2		0,3Ω-50kΩ	
053 400 S	4W	500 V	800 V	500 V	± 10		5Ω-100kΩ	
					± 5		5Ω-100kΩ	
					± 2		5Ω-100kΩ	
053 500 U	5W	500 V	800 V	500 V	± 10		5Ω-100kΩ	
					± 5		5Ω-100kΩ	
					± 2		5Ω-100kΩ	
053 500 S	5W	500 V	800 V	500 V	± 10		5Ω-150kΩ	
					± 5		5Ω-150kΩ	
					± 2		5Ω-150kΩ	

7. Power rating:

Resistors shall have a power rating based on continuous full load operation at an ambient temperature of 70 ℃. For temperature in excess of 70 ℃, the load shall be derated as shown in the figure below for 1/4W and 1/2W:



Derating for 1W to 9W:



8. Voltage rating:

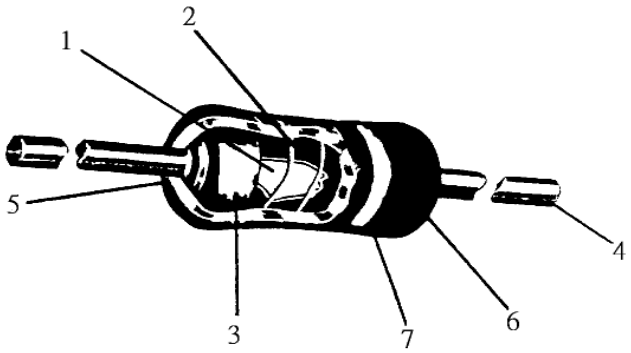
The resistor shall have a DC continuous working voltage or a rms AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined from the following:

E= Rated voltage [V]

P= Power rating [W] $E = \sqrt{R \bullet P}$

R= Nominal resistance [Ω]

9. Structure Diagram



No.	Name	Material
1	Basic Body	Rod Type Ceramics
2	Resistance Film	Metal Oxide Film
3	End Cap	Steel (Tin plated iron surface)
4	Lead Wire	Annealed copper wire coated with tin
5	Joint	By welding
6	Coating	Normal size: --Insulated & Non-Flame Paint (Color : Grey) Small size: --Insulated & Non-Flame paint (Color : Sea-Blue)
7	Color Code	Refer to 2. Marking

10. Nominal Resistance

Effective figures of nominal resistance shall be in accordance with E-24 series, and resistance tolerance shall be shown by table above.

11. Characteristics

Characteristics	Limits	Test Methods (JIS C 5201-1)
DC. resistance	Must be within the specified tolerance	The limit of error of measuring apparatus shall not exceed allowable range or 5% of resistance tolerance (Sub-clause 4.5)
Insulation resistance	Insulation resistance is 20 MΩ Min	Resistors shall be clamped in the trough of a 90° metallic V-block or foil method use a metal foil shall be wrapped closely around the body of the resistor. After that shall be tested at DC potential respectively specified in the above list for 60 +10/-0 secs. (Sub-clause 4.6)
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	Resistors shall be clamped in the trough of a 90° metallic V-block or foil method use a metal foil shall be wrapped closely around the body of the resistor. After that shall be tested at AC potential respectively specified in the table 1. for 60 +10/-0 secs. (Sub-clause 4.7)
Temperature coefficient	Please refer to Specification above	Natural resistance change per temp. degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \bullet 10^6$ (PPM/°C) R_1: Resistance value at room temperature (t_1) R_2: Resistance value at room temp. plus 100℃ (t_2) (Sub-clause 4.8)
Short time overload	Resistance change rate is Normal size ± (1 % + 0,05Ω) Small size ± (2 % + 0,05Ω) Max. with no evidence of mechanical damage	Permanent resistance change after the application of a potential of 2.5 times RCWV or the max. overload voltage respectively specified in the above list, whichever less for 5 seconds. (Sub-clause 4.13)
Terminal strength	No evidence of mechanical damage.	**Direct load**: Resistance to a 2,5 kg direct load for 10 sec. in the direction of the longitudinal axis of the terminal leads. **Twist test :** Terminal leads shall be bent through 90 ° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations. (Sub-clause 4.16)
Solderability	95 % coverage Min.	The area covered with a new, smooth clean, shiny and continuous surface free from concentrated pinholes. Test temp. of solder : 245℃ ± 3℃ Dwell time in solder : 2 ~ 3 seconds (Sub-clause 4.17)

<table>
<tr><td>Soldering temp. reference</td><td>Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)</td><td>The leads immersed into solder bath to 3,2 to 4,8 mm. from the body. Permanent resistance change shall be checked.
<u>Wave soldering condition: (2 cycles Max.)</u>
Pre-heat : 100 ~ 120 ℃, 30 ± 5 sec.
Suggestion solder temp.: 235 ~ 255 ℃, 10 sec. (Max.)
Peak temp.: 260 ℃
<u>Hand soldering condition:</u>
Hand Soldering bit temp.: 380 ± 10 ℃
Dwell time in solder: 3 +1/-0 sec.</td></tr>
<tr><td>Resistance to soldering heat</td><td>Resistance change rate is ± (1% + 0,05Ω) Max. with no evidence of mechanical damage.</td><td>Permanent resistance change when leads immersed to 3,2 to 4,8 mm from the body in 350℃ ± 10 ℃ solder for 3 ± 0,5 seconds
(Sub-clause 4.18)</td></tr>
<tr><td>Temperature cycling</td><td>Resistance change rate is ± (2% + 0,05Ω) Max. with no evidence of mechanical damage.</td><td>Resistance change after continuous 5 cycles for duty shown below:<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>-55℃ ±3℃</td><td>30 min</td></tr><tr><td>2</td><td>Room temp.</td><td>10～15 min</td></tr><tr><td>3</td><td>+155℃ ±2℃</td><td>30 min</td></tr><tr><td>4</td><td>Room temp.</td><td>10～15 min</td></tr></table>(Sub-clause 4.19)</td></tr>
<tr><td>Vibration</td><td>Resistance change rate is ± (1% + 0,05Ω) Max.</td><td>55Hz, 3 planes 2hrs each Total amplitude = 1,5mm
(Sub-clause 4.22)</td></tr>
<tr><td>Load life in humidity</td><td><table><tr><th>Resistance value</th><th>ΔR/R</th></tr><tr><td>Less than 100kΩ</td><td>± 5%</td></tr><tr><td>100kΩ or higher</td><td>± 10%</td></tr></table></td><td>Resistance change after 1,000 hours operating at RCWV with duty cycle of (1,5 hours "on", 0,5 hour "off") in a humidity test chamber controlled at 40 ℃ ± 2 ℃ and 90 to 95 % relative humidity
(Sub-clause 4.24.2.1)</td></tr>
<tr><td>Load life</td><td><table><tr><th>Resistance value</th><th>ΔR/R</th></tr><tr><td>Less than 100kΩ</td><td>± 5%</td></tr><tr><td>100kΩ or higher</td><td>± 10%</td></tr></table></td><td>Permanent resistance change after 1,000 hours operating at RCWV with duty cycle of (1,5 hours "on", 0,5 hour "off") at 70℃ ± 2℃ ambient
(Sub-clause 4.25.1)</td></tr>
<tr><td>Resistance to solvent</td><td>No deterioration of protective coatings and markings</td><td>Specimens shall be immersed in a bath of Isopropyl alcohol completely for 3 minutes with ultrasonic
(Sub-clause 4.30)</td></tr>
<tr><td>Pulse overload</td><td>Resistance change rate is
Normal size ± (2 % + 0,05Ω)
Small size ± (5 % + 0,05Ω) Max. with no evidence of mechanical damage</td><td>Resistance change after 10.000 cycles (1 sec. "on", 25 sec. "off") at 4 times RCWV or the max. pulse overload voltage
(Sub-clause 5.8)</td></tr>
</table>

Environment Related Substance:

This product comply to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances. Ozone depleting substances are not used in our manufacturing process of these products.

This product is not manufacture using Chloro fluorocabons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substance in any phase of the manufacturing process.

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