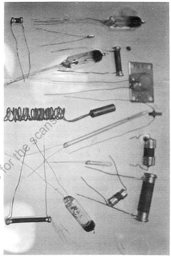
ITT COMPONENTS

THERMISTORS
N.T.C.
&
P.T.C.

Thermistors — Negative Temperature Coefficient



Introduction

Thermistors are thermally sensitive resistors suitable for many applications, including temperature measurement, control and compensation, current surge suppression, power measurement, amplitude control, trigger circuits, measurement of velocity of liquids or gases, etc.

Bead thermistors, directly or indirectly heated, are small devices suitable for low power applications.

Disc types are suitable for use at higher power levels and are all directly heated.

Rod types (Brimistors) are broad tolerance thermistors, particularly suitable for surge suppression and compensation for resistance variation of other components, in radio, television, telecommunication and projection equipment.

Negative temperature coefficient thermistors have a temperature coefficient of resistance at 20°C of approximately ten times that of copper. The resistance (R_{T_1}) of a thermistor at a temperature T_1 (°K) can be related to the resistance (R_{T_2}) at any other temperature T_2 (°K) by the following equation:

$$R_{T_1} = R_{T_2}\, e^{\left(\frac{B}{T_1} - \frac{B}{T_2}\right)}$$

where B is the characteristic temperature of the thermistor expressed in °K.

Where thermistors are designed to change their resistance as a result of an external change in temperature (e.g. F and M types), the power dissipated in them should be kept low since an appreciable electrical heating by the indicating circuit current will produce a false result. Similarly, those types which are designed to be heated electrically (e.g. A and B) are not, in general, suitable for applications where they may be required to sense variations of temperature.

GENERAL GUIDE TO APPLICATIONS

Application	* Preferred types	Alternative types
Temperature measurement and control	D, F, FS, G, GL, GT, P, U	KR, KT, KU
Temperature compensation	G, GL, GT, KR, KT, KU	KB
Gas and liquid flow measurements	D, F, FS, P, U	GT, GL
Katharometry, anemometry	D, F, FS, P, U	
Low frequency power measurement	A, AT, B, E, L, R	GT, KR, KU, U
Power measurement up to and including 'X' band	E	U
Surface temperature measurement	M, KB	U
Amplitude and gain control	A, AT, B, E, L, R	GT
Surge suppression	C, CZ, CZA (Brimistors)	

** See subsequent pages for details*

GRAPHS ON ANY TYPE AVAILABLE ON REQUEST.

Standard Telephones and Cables Pty. Limited

DESCRIPTION OF STANDARD BEAD AND DISC TYPES

Type	Description	Standard physical variations
A	Bead in gas-filled glass envelope	—
AT	As type A but mounted in cartridge-type fuse holder	—
B	Indirectly heated bead in evacuated glass envelope	—
C	Rod type thermistor (Brimistor) without connecting wires	—
CZ & VZA	Rod types (Brimistors) with connecting wires	—
D	Bead in end of glass probe	—
E	Bead in gas-filled envelope	—
F	Bead sealed in 'pip' at end of glass probe	—
FS	Bead in end of glass probe	Two lengths of probe
G	Bead in solid glass pellet	Three diameters of pellet
GL	Bead in solid glass pellet	—
GT	As type G but mounted and potted inside nickel-plated case	Two sizes of case
KB	Disc mounted on metal plate (KBS Stud Type)	—
KR	Painted disc with radial lead wires	—
KT	Unpainted disc with radial lead wires	—
KU	Unpainted disc without leads	—
L	Indirectly heated bead in gas-filled glass envelope	—
M	Glazed bead mounted on nickel-iron alloy disc	—
P	Glazed bead suspended beyond end of glass probe	—
R	Bead in evacuated glass envelope	—
U	Unmounted glazed bead with platinum-ruthenium alloy leads	Single or double-ended lead arrangement

Matched pairs of thermistors

Thermistors are available to order in matched pairs of the following types: D, F, FS, G, M, P and U.

The resistance of each resistor is matched to within 1% at 20°C, both thermistors being within the ±20% tolerance of nominal resistance.

Key to Symbols

R_0 = Resistance at 0°C
R_{20} = Resistance at 20°C
R_{25} = Resistance at 25°C
R_{50} = Resistance at 50°C
R_{100} = Resistance at 100°C
R_{min} = Min. operating resistance

k = Dissipation constant
P_{max} = Max. continuous power dissipation
I_{max} = Max. operating current
I_{PK} = Max. instantaneous current
T_A = Ambient temperature
T_B = Bead or disc temperature

B = Characteristic temperature (°K) defined by the equation

$R_T = R_\infty e^{(B/T)}$ where R_T is the resistance at T(°K)

$$\therefore B = \frac{T_1 \times T_2}{\Delta T} \log_e \frac{R_{T_1}}{R_{T_2}}$$

where R_{T_1} and R_{T_2} are resistances at specified temperatures T_1 and T_2 (°K)

DIRECTLY HEATED BEAD TYPES

Types A and AT

Type A: Bead in glass envelope for amplitude control and timing devices.

Type AT: As type A but mounted inside cartridge-type fuseholder.

Suffix B: k = 0.28 mW/°C

Suffix C: k = 0.77 mW/°C

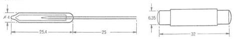
$T_{A\,max}$ = 150°C

P_{max} = 60 mW at 20°C

P_{max} = 200 mW at 20°C

$T_{B.max}$ = 220°C

Type A Type AT



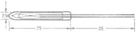
Dimensions in mm

Code	R20	R25	Rmin	B
A55B and C and AT55B and C	500 kΩ	390 kΩ	950 Ω	4,350
A25B and C and AT25B and C	200 kΩ	160 kΩ	510 Ω	4,150
A25PO* and AT25PO*	200 kΩ	160 kΩ	510 Ω	4,150
A15B and C and AT15B and C	100 kΩ	79.5 kΩ	320 Ω	4,000
A54B and C and AT54B and C	50 kΩ	40.5 kΩ	210 Ω	3,800
A24B and C and AT24B and C	20 kΩ	16.5 kΩ	110 Ω	3,600
A14B and C and AT14B and C	10 kΩ	8.25 kΩ	75 Ω	3,400
A53B and C and AT53B and C	5 kΩ	4.15 kΩ	46 Ω	3,250
A23B and C and AT23B and C	2 kΩ	1.7 kΩ	25 Ω	3,050
A13B and C and AT13B and C	1 kΩ	850 Ω	15 Ω	2,900
A52B and C and AT52B and C	500 Ω	430 Ω	12 Ω	2,700

As A25B and AT25B but selected for close tolerance thermal time constant

Type D

Bead inside glass probe for temperature measurement and control; flow measurement.



k = 0.85 mW/°C

T_{Amax} = 300°C

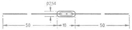
P_{max} = 100 mW to 200 mW (depending on external medium)

T_{Bmax} = 300°C

Code	R_{20}	R_{25}	R_{min}	B
D23	2 kΩ	1.7 kΩ	13 Ω	3,050

Type E

Bead in glass envelope for power measurements at 'X' band frequencies.



k = 0.125 mW/°C

T_{Amax} = 175°C

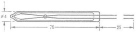
P_{max} = 25 mW at 20°C

T_{Bmax} = 220°C

Code	R_{20}	R_{25}	R_{min}	B
E23	2.3 kΩ	2 kΩ	40 Ω	2,950

Type F

Bead in glass probe for temperature measurement and control; flow measurement.



k = 0.85 mW/°C

T_{Amax} = 300°C

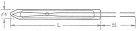
P_{max} = 100 mW to 200 mW (depending on external medium)

T_{Bmax} = 300°C

Code	R_{20}	R_{25}	R_{min}	B
F15D	100 kΩ	79.5 kΩ	130 Ω	4,000
F14D	10 kΩ	8.25 kΩ	35 Ω	3,400
F53D	5 kΩ	4.15 kΩ	22 Ω	3,250
F23D	2 kΩ	1.7 kΩ	13 Ω	3,050
F22D	200 Ω	175 Ω	3 Ω	2,500

Type FS

Bead inside glass probe for temperature measurement and control; flow measurement.



k = 1.3 mW/°C

T_{Amax} = 300°C

P_{max} = 100 mW to 200 mW (depending on external medium)

T_{Bmax} = 300°C

Suffix B : L = 25.4 mm

Suffix D : L = 76.2 mm

Code	R_{20}	R_{25}	R_{min}	B
FS15B and D	100 kΩ	79.5 kΩ	130 Ω	4,000
FS23B and D	2 kΩ	1.7 kΩ	13 Ω	3,050
FS22B and D	200 Ω	175 Ω	3 Ω	2,500

Type G

Bead in solid glass pellet for temperature measurement, control and compensation.

Suffix B (Standard size) k = 1.5 mW/°C ϕd = 4.0 mm
Suffix C (Miniature) k = 1.3 mW/°C ϕd = 3.0 mm
Suffix D (Sub-miniature) k = 1.1 mW/°C ϕd = 2.5 mm

High resistance types
T_{Amax} = 300°C T_{Bmax} = 300°C
P_{max} at 20°C = 420 mW (B), 370 mW (C), 310 mW (D)

Code	R_{20}	R_{100}	R_{min}	B
G26B, C and D	2 MΩ	60 kΩ	300 Ω	5,000
G16B, C and D	900 kΩ	30 kΩ	170 Ω	4,850
G55B, C and D	500 kΩ	15 kΩ	100 Ω	4,700

Medium resistance types
T_{Amax} = 155°C T_{Bmax} = 200°C
P_{max} at 20°C = 270 mW (B), 235 mW (C), 200 mW (D)

Code	R_{20}	R_{25}	R_{min}	B
G25B, C and D	200 kΩ	155 kΩ	700 Ω	4,250
G15B, C and D	100 kΩ	79.5 kΩ	420 Ω	4,050
G54B, C and D	50 kΩ	40 kΩ	290 Ω	3,900
G24B, C and D	20 kΩ	16 kΩ	150 Ω	3,700
G14B, C and D	10 kΩ	8.2 kΩ	100 Ω	3,500

Low resistance types
T_{Amax} = 125°C T_{Bmax} = 125°C
P_{max} at 20°C = 160 mW (B), 140 mW (C), 120 mW (D)

Code	R_{20}	R_{25}	R_{min}	B
G53B, C and D	5 kΩ	4.15 kΩ	210 Ω	3,350
G23B, C and D	2 kΩ	1.65 kΩ	115 Ω	3,200
G13B, C and D	1 kΩ	845 Ω	70 Ω	2,950
G52B, C and D	500 Ω	425 Ω	38 Ω	2,800
G22B, C and D	200 Ω	170 Ω	18 Ω	2,600

DIRECTLY HEATED BEAD NTC THERMISTORS

Type GL

Bead in solid glass pellet for temperature measurement and control, flow measurement and liquid level detection.

k = 1.2 mW/°C

High resistance types

P_{max} = 340 mW at 20°C
$T_{A\ max}$ = 300°C
$T_{B\ max}$ = 300°C

Code	R_{20}	R_{100}	$R_{min.}$	B
GL26	2 MΩ	60 k Ω	300 Ω	5,000
GL16	1 MΩ	30 k Ω	170 Ω	4,850
GL55	500 k Ω	15 k Ω	100 Ω	4,750

Medium resistance types

P_{max} = 220 mW at 20°C
$T_{A\ max}$ = 155°C
$T_{B\ max}$ = 200°C

Code	R_{20}	R_{25}	R_{min}	B
GL25	200 kΩ	155 kΩ	700 Ω	4,250
GL15	100 kΩ	79.5 kΩ	420 Ω	4,050
GL54	50 kΩ	40 kΩ	290 Ω	3,900
GL24	20 kΩ	16 kΩ	150 Ω	3,700
GL14	10 kΩ	8.2 kΩ	100 Ω	3,500

Low resistance types

P_{max} = 130 mW at 20°C
$T_{A\ max}$ = 125°C
$T_{B\ max}$ = 125°C

Code	R_{20}	R_{25}	R_{min}	B
GL53	5 kΩ	4.15 kΩ	210 Ω	3,350
GL23	2 kΩ	1.65 kΩ	115 Ω	3,200
GL13	1 kΩ	845 Ω	70 Ω	2,950
GL52	500 Ω	425 Ω	38 Ω	2,800
GL22	200 Ω	170 Ω	18 Ω	2,600

Type GT

Bead in solid glass pellet mounted in a metal can for temperature measurement, control and compensation.

Suffix B: Machine nickel plated brass can
L = 19.1 mm, ød = 6.35 mm
Suffix C: Pressed nickel plated copper can
L = 14 mm, ød = 4.35 mm
k = 3.2 mW/°C
$T_{A\ max}$ = 125°C
P_{max} = 300 mW at 20°C
$T_{B\ max}$ = 125°C

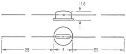
Code	R_{20}	R_{25}	R_{min}	B
GT25B and C	200 kΩ	155 kΩ	3,700 Ω	4,250
GT15B and C	100 kΩ	79.5 kΩ	2,200 Ω	4,050
GT54B and C	50 kΩ	40 kΩ	1,400 Ω	3,900
GT24B and C	20 kΩ	16 kΩ	650 Ω	3,700
GT14B and C	10 kΩ	8.2 kΩ	400 Ω	3,500
GT53B and C	5 kΩ	4.15 kΩ	210 Ω	3,350
GT23B and C	2 kΩ	1.65 kΩ	115 Ω	3,200
GT13B and C	1 kΩ	845 Ω	70 Ω	2,950
GT52B and C	500 Ω	425 Ω	38 Ω	2,800
GT22B and C	200 Ω	170 Ω	18 Ω	2,600

High resistance types

Code	R_{20}	R_{100}	R_{min}	B
GT26B and C	2 MΩ	60 kΩ	20 kΩ	4,800
GT16B and C	900 kΩ	30 kΩ	12 kΩ	4,650
GT55B and C	500 kΩ	15 kΩ	7.2 kΩ	4,500

Type M

Bead on metal disc for surface temperature measurement and control.



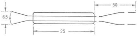
k = 1 mW/°C
5 mW/°C on infinite heat sink
P_{max} = 300 mW
1.5 W on infinite heat sink

Code	R_{20}	R_{25}	R_{min}	B	Max. operating temperature
M15	100 kΩ	79.5 k Ω	120 Ω	4,050 Ω	300°C
M53	5 k Ω	4.15 kΩ	65 Ω	3,350 Ω	200°C
M52	500 Ω	425 k Ω	65 Ω	2,800 Ω	100°C

Thermistors — NTC Directly Heated Beads

Type P

Unencapsulated glazed bead on glass probe for katharometry, anemometry and other flow measurements.

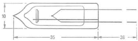


Code	R_{20}	R_{25}	R_{min}	B
P25	200 kΩ	160 kΩ	1,600Ω	4,000
P15	100 kΩ	80.5 kΩ	1,030Ω	3,800
P23	2 kΩ	1.7 kΩ	60Ω	2,900

k = 87 μW/°C
$T_{A\ max}$ = 180°C
P_{max} = 14 mW at 20°C
$T_{B\ max}$ = 180°C

Type R

Bead sealed in glass envelope for operation at very low power levels, e.g. in transistor circuits

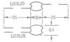


k = 16 μW/°C
$T_{A\ max}$ = 175°C
P_{max} = 3 mW at 20°C
$T_{B\ max}$ = 220°C

Code	R_{20}	R_{25}	R_{min}	B
R25	200 kΩ	160 kΩ	790 Ω	4,000
R15	100 kΩ	80.5 kΩ	520 Ω	3,800
R54	50 kΩ	40.3 kΩ	270 Ω	3,650
R24	20 kΩ	16.5 kΩ	150 Ω	3,400
R14	10 kΩ	8.3 kΩ	92 Ω	3,250
R53	5 kΩ	4.2 kΩ	63 Ω	3,100
R23	2 kΩ	1.7 kΩ	30 Ω	2,900
R13	1 kΩ	860 Ω	24 Ω	2,700
R52	500 Ω	430 Ω	13 Ω	2,550

Type U

Unmounted glazed bead



Code	R_{20}	R_{25}	R_{min}	B
U23UD	2 kΩ	1.7 k Ω	60 Ω	2,900
U23US	2 kΩ	1.7 k Ω	60 Ω	2,900

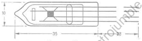
Suffix D: double-ended
k = 87 μW/°C
$T_{A\ max}$ = 180°C

Suffix S: single ended
P_{max} = 14 mW at 20°C
$T_{B\ max}$ = 180°C

Indirectly Heated Bead Types

Type B

Bead sealed in glass envelope for amplitude gain control, power measurement and timing devices.



k = 0.18 mW/°C at 20°C
$T_{A\ max}$ = 155°C
Heater resistance 100 Ω ±5%
P_{max} = 36 mW at 20°C
(total, bead and heater)
$T_{B\ max}$ = 220°C

Code	R_{20}	R_{25}	R_{min}	B
B55	500 kΩ	390 kΩ	940 Ω	4,400
B25	200 kΩ	160 kΩ	470 Ω	4,250
B15	100 kΩ	79.5 kΩ	270 Ω	4,150
B54	50 kΩ	40.5 kΩ	180 Ω	3,950
B24	20 kΩ	16.5 kΩ	95 Ω	3,750
B14	10 kΩ	8.25 kΩ	64 Ω	3,550
B53	5 kΩ	4.15 kΩ	40 Ω	3,400
B23	2 kΩ	1.7 kΩ	23 Ω	3,150
B13	1 kΩ	850 Ω	14.5Ω	3,000
B52	500 Ω	530 Ω	10Ω	2,800

Type L

Bead sealed in glass envelope for timing circuits.
Physical outline as Type B

k = 1.0 mW/°C at 20°C
$T_{A\ max}$ = 155°C
Heater resistance 100 Ω ± 5%
P_{max} = 200 mW at 20°C
(total, bead and heater)
$T_{B\ max}$ = 220°C

Code	R_{20}	R_{25}	R_{min}	B
L55	500 kΩ	390 kΩ	940 Ω	4,400
L25	200 kΩ	160 kΩ	470 Ω	4,250
L15	100 kΩ	79.5 kΩ	270 Ω	4,150
L54	50 kΩ	40.5 kΩ	180 Ω	3,950
L24	20 kΩ	16.5 kΩ	95 Ω	3,750
L14	10 kΩ	8.25 kΩ	64 Ω	3,550
L53	5 kΩ	4.15 kΩ	40 Ω	3,400
L23	2 kΩ	1.7 kΩ	23 Ω	3,150
L13	1 kΩ	850 Ω	14.5Ω	3,000
L52	500 Ω	430 Ω	10 Ω	2,800

DISC TYPES

Type KB

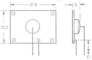
Disc mounted on a metal plate for surface temperature measurement, temperature compensation and control.

k = 23 to 100 mW/°C according to mounting

P_{max} = 2.3 to 10 W at 20°C according to mounting

$T_{A\ max}$ = 125°C

$T_{B\ max}$ = 125°C



Code	R_{20}	R_{25} Nominal	R_{min}	B
KB472	6.0 kΩ	4.7 kΩ	126 Ω	4,350
KB222	2.8 kΩ	2.2 kΩ	67 Ω	4,200
KB102	1.25 kΩ	1.0 kΩ	36 Ω	4,050
KB471	580 Ω	470 Ω	20 Ω	3,850
KB221	270 Ω	220 Ω	12 Ω	3,650
KB101	120 Ω	100 Ω	6.2 Ω	3,450
KB470	56.5 Ω	47 Ω	3.5 Ω	3,300
KB220	26 Ω	22 Ω	2.0 Ω	3,100
KB100	12 Ω	10 Ω	1.1 Ω	2,900
KB047	5.5 Ω	4.7 Ω	0.62 Ω	2,700

Type KBS

NTC disc thermistor encapsulated in the head of a threaded stud for mounting on surface of a metal plate for block. Good thermal contact is important when mounting the termistor.

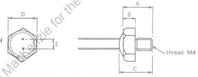
Type	Resistance at 25°C (R25) nominal (Ω)	Resistance at 120°C (R120) nominal (Ω)	B value (25–85)°C nominal (°K)	Temperature Coefficient at 25°C approximately (%/deg C)
KBS 100	10	1.2	2,650	3.0
KBS 101	100	8.8	3,000	3.4
KBS 102	1,000	56.0	3,550	4.0
KBS 103	10,000	361.0	4,100	4.6

Dimension	mm	in
A ±0.2 mm	9.9	0.39
B ±0.15 mm	4	0.158
C Maximum	12	0.47
D ±0.15 mm	10	0.394
E Nominal	4	0.16

Material of stud
Aluminium Alloy

Terminal wires
Length 75 mm (2.95in) minimum
Diameter 0.5 mm (0.020in) nominal

Inch dimensions are derived from metric dimensions.



Types KR, KT and KU

Unmounted discs for temperature measurement, control and compensation.

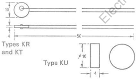
TYPE KR Standard disc type having radial leads, for industrial applications. (Supplied painted.)

TYPE KT Disc type having radial leads, for commercial applications. (Supplied unpainted.)

TYPE KU Disc type without leads.

k = 10 mW/°C $T_{A\ max}$ = 125°C

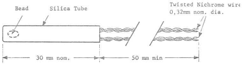
P_{max} = 1 W $T_{B\ max}$ = 125°C



Code	R_{20}	R_{25} Nominal	R_{min}	B
KR472C, KT472B, KU472	6.0 kΩ	4.7 kΩ	126 Ω	4,350
KR332C, KT332B, KU332	4.2 kΩ	3.3 kΩ	96 Ω	4,300
KR222C, KT222B, KU222	2.8 kΩ	2.2 kΩ	67 Ω	4,200
KR152C, KT152B, KU152	1.9 kΩ	1.5 kΩ	50 Ω	4,100
KR102C, KT102B, KU102	1.25 kΩ	1.0 kΩ	36 Ω	3,050
KR681C, KT681B, KU681	850 Ω	680 Ω	27 Ω	3,950
KR471C, KT471B, KU471	580 Ω	470 Ω	20 Ω	3,850
KR331C, KT331B, KU331	405 Ω	330 Ω	15 Ω	3,750
KR221C, KT221B, KU221	270 Ω	220 Ω	12 Ω	3,650
KR151C, KT151B, KU151	180 Ω	150 Ω	8.6 Ω	3,550
KR101C, KT101B, KU101	120 Ω	100 Ω	6.2 Ω	3,450
KR680C, KT680B, KU680	81.5 Ω	68 Ω	4.6 Ω	3,400
KR470C, KT470B, KU470	56.5 Ω	47 Ω	3.5 Ω	3,300
KR330C, KT330B, KU330	39.5 Ω	33 Ω	2.6 Ω	3,200
KR220C, KT220B, KU220	26 Ω	22 Ω	2.0 Ω	3,100
KR150C, KT150B, KU150	18 Ω	15 Ω	1.5 Ω	3,000
KR100C, KT100B, KU100	12 Ω	10 Ω	1.1 Ω	2,900
KR068C, KT068B, KU068	8 Ω	6.8 Ω	0.83 Ω	2,800
KR047C, KT047B, KU047	5.5 Ω	4.7 Ω	0.62 Ω	2,700

Type H

The HT 103/750 is a newly developed thermistor primarily intended for temperature measurement and control at high temperatures. The operating range is 500°C to 1,000°C and the typical temperature coefficient of resistance at 750°C is -1%/°C.



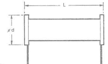
Characteristics

Resistance at 750°C (2v applied)	10K ohms
Resistance tolerance at 750°C	± 30%
B value (750°C to 1,000°C - 2v applied)	12500°K
Tolerance on B value	± 10%
Dissipation constant	3.5mW
Maximum recommended applied voltage	10v d.c
Minimum recommended applied voltage	2v d.c.
Time constant	3s

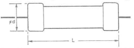
Brimistors NTC

Rod type thermistors of broad resistance tolerance, primarily for surge suppression and compensation for resistance variation in associated components.

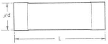
Type CZ



Type CZA



Type C



Type	R_0 (Ω)	R_{20} (Ω)	R_{50} (Ω)	R_{min} (Ω)	I_{max}† (A)	I_{pk}‡ (A)	L (mm)	ø d (mm)
CZ1 CZ1A	8,300	3,800	1,400	44	0.3	0.6	32	8.0
CZ2	12,500	5,500	1,850	38	0.3	0.4	22	6.0
CZ3	3,500	1,500	560	35	0.2	0.3	8.0	5.0
CZ4 C4 CZ4A	1,700	800	320	5.5	0.8	1.2	38	11
CZ6	6,000	3,000	1,120	27	0.45	0.7	32	10
CZ8A	3,700	1,600	620	30	0.3	0.6	16	8.0
CZ9A	800	350	130	3.7	0.6	1.0	16	8.0
CZ10	26,000	11,000	4,000	148	0.075	0.15	8.0	2.4
CZ11	280	140	65	2.5	1.5	2.5	32	10
CZ12	240	120	53	1.5	2.5	4.0	38	11
CZ13A	950	450	180	6.0	0.8	1.2	19	11
CZ25	200	100	44	2.0	1.5	2.5	22	10

$*T_A = 20°C$. At higher ambients, R_{min} will be somewhat lower. † At $T_A < 50°C$
‡ Duration < 20 ms

See Back Page for some Brimistor Applications.

Thermistors — Positive Temperature Coefficient

Silistors

Silistors are thermally sensitive silicon resistors having a positive temperature coefficient of resistance.

Applications

Temperature measurement, control and compensation, and voltage stabilisation.

Characteristics

Temperature coefficient at 25°C
0.77%/°C

Operating temperature range
−60°C to + 150°C

Maximum power dissipation up to 35°C
1.5 W

Dissipation constant
11 mW/°C

The law governing the variation of resistance with temperature is approximately:

$R = R_{25} \left(\frac{T}{298}\right)^{2.3}$ where T = Temperature (°K).

Departure of the order of 5% from this law may occur at temperatures above 140°C.

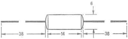
The law governing the variation of resistance with power dissipation is approximately:

$R = Rz (1 + 0.7 P)$

where Rz = Resistance at zero power dissipation

P = Power (W) dissipated in the silistor

Resistance (±20%) at 25°C (Ω)	
T100W	10
T150W	15
T220W	22
T330W	33
T470W	47
T680W	68
T101W	100
T151W	150
T221W	220
T331W	330
T471W	470



Positte Thermistors

Applications

Temperature control* and compensation.

Measurement of liquid or gas flow, pressure and thermal resistance.

Sensing of liquid levels.

* Primary application is detecting excessive temperatures inside industrial equipment, especially within windings of electro-magnetic equipment. By monitoring hot spots, maximum output can be taken from the machine instead of allowing excessive temperature safety margins, and is particularly useful in irregular stop-start operation. The principle equally applies to boilers, bearings, etc.

PREFERRED RANGE

Code	Tr °C	Disc Size (max) mm	Lead Wires: Length (nom) mm	Lead Wires: Colour *
YC080TA	80	5	200	White — white
YC090TD	90	3	130	Green — green
YC095TC	95	5	130	Green — red
YC100TA	100	5	200	Red — red
YC110TB	119	3	200	Brown — brown
YC120TC	120	5	130	Grey — grey
YC130TA	130	5	200	Blue — blue
YC130TB	130	3	200	Blue — blue
YC140TA	140	5	200	Blue — black
YC155TA	155	5	200	Black — black
YG130TB	130	3	200	Blue — blue

* The different temperatures are distinguished by coloured leads.

FOR FULL INFORMATION ON POSITTE ASK FOR CDD6 DATA SHEET.

BRIMISTOR APPLICATION

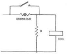
Brimistors are broad tolerance rod-type thermistors, which are particularly suitable for surge suppression and resistance variation compensation of other components in radio, television, telecommunication and projection equipment. The resistance of a Brimistor decreases with rising temperature, and so does its temperature coefficient. Thus a rise of about 20°C above room temperature will halve its resistance, but at 250°C an increase of 50°C is necessary to halve the resistance value.

Thermal Characteristics

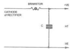
The rate of heating and consequent change of resistance of a Brimistor depends upon its mass, how it is mounted, and the circuit conditions in which it is employed; and the rate of cooling upon its mass and the difference between operating and ambient temperatures. To choose the most suitable type of Brimistor for a specific application, consider the characteristics and ratings of the various types.

Time Delay of Relay

A large range of time delays can be obtained by suitable selection of Brimistor and shunt. The circuit must be so arranged that E_{max} is exceeded at switch-on, resulting in self-heating. Delay time increases with the size of shunt resistance, and further with the use of a series resistance. For small tolerance in delay time, the Brimistor should operate at high temperature, to reduce the effect of ambient variations. Short circuiting the Brimistor when the relay closes allows it to cool and permits a fresh delay immediately after the relay reopens.



Time Delay of Relays



Protection of Rectifier and Reservoir Capacitors

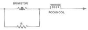
Protection of Rectifiers and Reservoir Capacitors

The large switch-on current surge obtained with the large reservoir capacitors of capacitor input filters may be reduced by connecting a Brimistor between the rectifier cathode and the HT + side of the reservoir capacitor. The circuit shown is equally suitable for silicon of thermionic rectifiers.

Recommended types are:

Direct Current up to 75mA	–CZ10
Direct Current up to 100mA	–CZ1 or CA1A
Direct Current of 100 to 100mA	–CZ6
Direct Current over 200mA	–CZ4

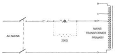
Compensation for Increase in Resistance of Focus Coils



Compensation for Increase in Resistance of Focus Coils

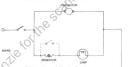
The increase of resistance of a focus coil, owing to its temperature rise while operating, may be compensated by connecting a Brimistor in series with and in close proximity to the coil. For exact compensation. a shunt resistance also may be needed. According to the current involved, Brimistor types CZ2 or CZ3 are normally suitable.

Protection from Switch-on Surges in Mains Transformers



Protection from Switch-on Surges in Mains Transformers

By using a Brimistor to limit the switch-on surge in the primary of mains transformers of TV and radio receivers, the rating of the fuse or other protective device in the primary circuit may be reduced, thus giving more efficient protection against overload from component breakdown. Type CZ9A is suitable but may require a shunting resistance to avoid peak surge current exceeding the Brimistor rating. A shunt of 200Ω, ½ to 1W should be suitable.



Protection of Projector Lamps

Protection of Projector Lamps.

For this purpose special Brimistors have been developed with resistance and mass chosen to give adequate surge suppression with negligible loss of light. Delay to full illumination is about 1/10 to ¼ sec. which represents satisfactory surge suppression.

If the projector has a fan it is preferable but not essential to connect the Brimistor in series with the lamp only.

For recurrent operation the Brimistor must be allowed to cool before reswitching on. Some surge suppression is achieved if cooling is incomplete but for maximum protection the full cooling time indicated in the table is required. The use of a short-circuiting switch, after the lamp is lit, allows the Brimistor to cool while the projector is running.

Lamp Wattage	Supply Voltage	Cooling Time	Brimistor
500W	200-250V	12 Mins.	CZ12
300 or 250W	200-250V	10 Mins.	CZ11
150W	200-250V	6 Mins.	CZ9A
250W	105-125V	12 Mins.	CZ12
150W	105-125V	10 Mins.	CZ11
75 or 50W	105-125V	6 Mins.	CZ9A

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