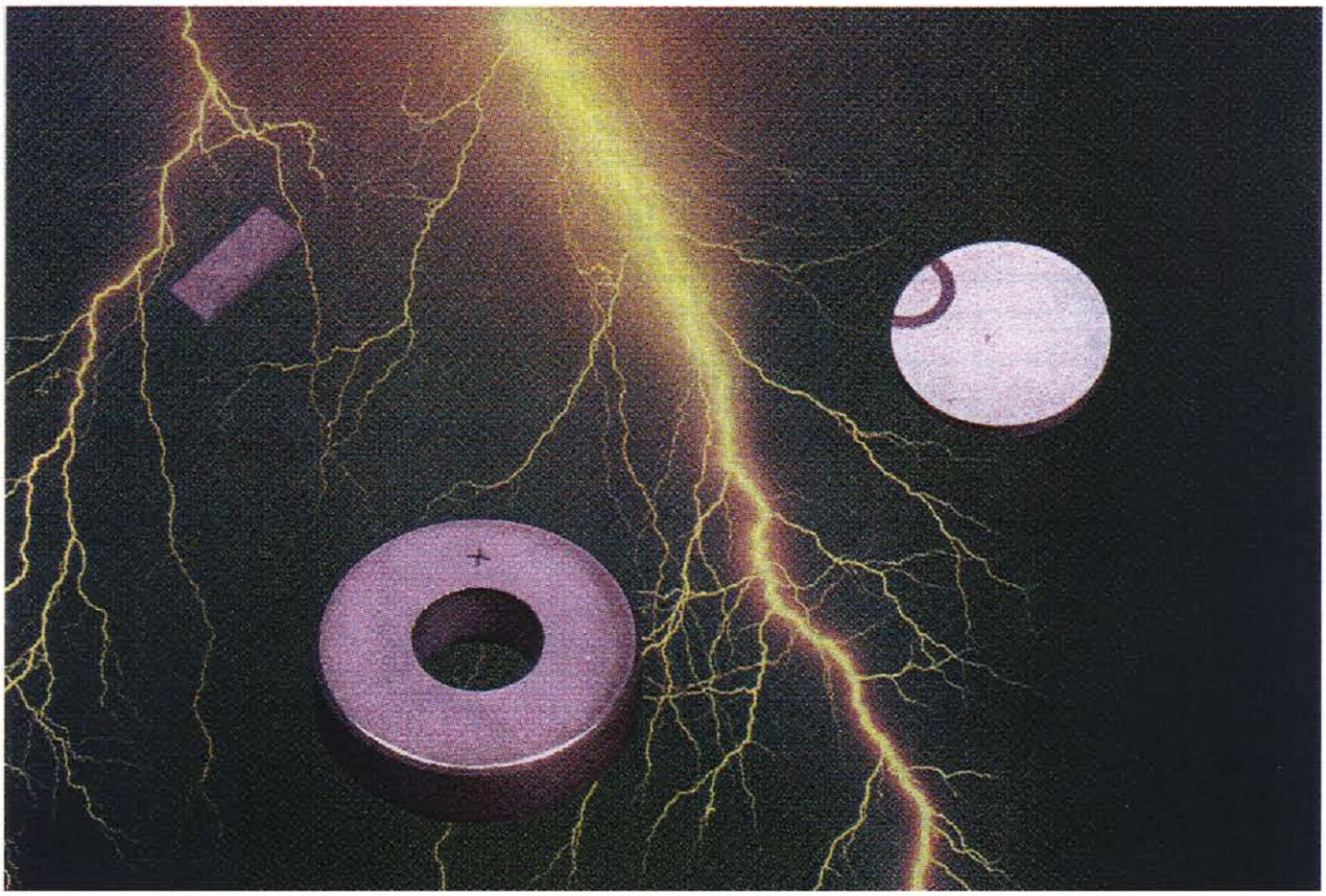
Piezoxide PXE



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SURVEY OF GRADES

The following grades, consisting of modified lead zirconate titanates, are distinguished according to their electrical and mechanical properties and field of application.

Table 1 gives typical values measured on discs Ø16 × 1 mm at 21 ±1 °C, 24 hours after poling.

The properties of components manufactured with these grades depend upon the dimensions of the product, the method of manufacture and on the applied voltage level. Therefore, a meaningful interpretation of the properties of the material is best made in consultation with the supplier.

Table 1 Typical values

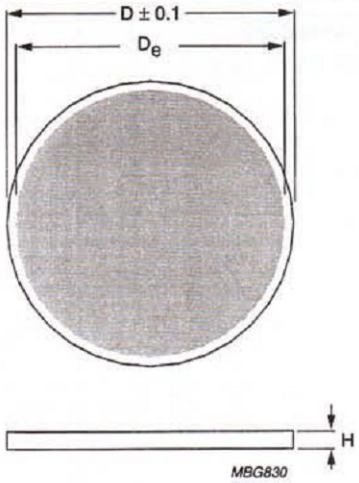
PROPERTY AND SYMBOL	PXE 5	PXE 52	PXE 59	PXE 21	PXE 41	PXE 42	PXE 43	PXE 71	UNIT
Thermal data									
Curie temperature	285	165	360	270	315	325	300	270	°C
Specific heat	420	420	420	420	420	420	420	420	J/kg K
Thermal conductivity	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	W/m K
Mechanical data									
Density ρ_m	7.8	7.8	7.9	7.8	7.9	7.8	7.8	7.8	10^3 kg/m^3
Compliance									
$S\frac{E}{33}$	18	20	18	19	15	15	13	–	10^{-12}/Pa
$S\frac{E}{11}$	15	16	16	15	12	13	11	15	10^{-12}/Pa
$S\frac{E}{55}$	39	–	45	–	37	–	–	38	10^{-12}/Pa
Poisson's ratio σ	0.3	0.3	0.35	0.3	0.3	0.3	0.3	0.3	
Mechanical quality factor for radial mode $Q\frac{E}{m}$	75	65	80	75	1200	750	1000	80	
Frequency constants									
$N\frac{E}{P}$	1975	1925	1970	2000	2175	2200	2350	2100	Hz m or m/s
$N\frac{D}{3} = 1/2\upsilon\frac{D}{3}$	1850	1800	2060	1900	2000	2015	2050	–	Hz m or m/s
$N\frac{E}{1} = 1/2\upsilon\frac{E}{1}$	1450	1400	1400	–	1620	–	–	1500	Hz m or m/s
$N\frac{E}{5} = 1/2\upsilon\frac{E}{5}$	930	–	900	–	950	–	–	920	Hz m or m/s
Compressive strength	>600	>600	>600	>600	>600	>600	>600	>600	10^6 Pa
Tensile strength	80	80	100	80	80	80	80	80	10^6 Pa

Piezoelectric Ceramics — Material grades

PROPERTY AND SYMBOL	PXE 5	PXE 52	PXE 59	PXE 21	PXE 41	PXE 42	PXE 43	PXE 71	UNIT
Electrical data									
Relative permittivity ($\varepsilon_0 = 8.85 \times 10^{-12}$ F/m)									
$\frac{\varepsilon^T_{33}}{\varepsilon_0}$	2100	3900	1850	2000	1225	1325	1000	1100	
$\frac{\varepsilon^T_{11}}{\varepsilon_0}$	1800	3300	1650	–	1400	–	–	1700	
Resistivity ρ	5	1	5	5	1	1	1	5	10^{12} Ωm
Time constant $\rho\varepsilon^T_{33}$ (25 °C)	>300	>500	>100	>25	>7	–	–	>250	minute
Dielectric loss factor tan δ	20	16	17	15	2.5	3.5	2	29	10^{-3}
Electro-mechanical data									
Coupling factor									
k_p	0.68	0.70	0.66	0.64	0.64	0.61	0.53	0.63	
k_{33}	0.75	0.80	0.71	0.74	0.74	0.70	0.66	0.73	
k_{31}	0.38	0.39	0.37	0.37	0.38	0.34	0.30	0.37	
k_{15}	0.66	–	0.68	–	0.70	–	–	0.68	
Piezoelectric charge constants									
d_{33}	500	700	460	450	325	315	230	340	10^{-12} C/N or m/V
d_{31}	–215	–280	–195	–200	–150	–130	–100	–150	10^{-12} C/N or m/V
d_{15}	515	–	550	–	480	–	–	500	10^{-12} C/N or m/V
Piezoelectric voltage constants									
g_{33}	24	20	28	25	30	27	27	30	10^{-3} Vm/N or m^2/C
g_{31}	–10	–10	–13	–12	–12	–11	–11	–10	10^{-3} Vm/N or m^2/C
g_{15}	33	–	37	–	39	–	–	33	10^{-3} Vm/N or m^2/C
Time stability (%)									
Coupling factor k_p	–0.5	–0.6	–0.1	–1.5	–1.5	–2.5	–2.0	–0.5	relative change per time decade (days)
Permittivity ε^T_{33}	–1.0	–1.0	–2.0	–2.0	1.0	–6.0	–4.5	–0.5	
Frequency constant $N\frac{E}{P}$	0.5	0.3	+0.1	0.5	0.5	1.5	1.0	0.5	
Quality factor $Q\frac{E}{m}$	–	–3.0	+0.1	–	10.0	–	–	–	
Dielectric loss factor tan δ	–	–	–0.1	–	–10	–	–	–	

DISCS WITH NICKEL ELECTRODES

Our standard range of discs with nickel electrodes is available in grade PXE 5. Other grades and sizes are available on request. The positive pole is marked.



Dimensions in mm.

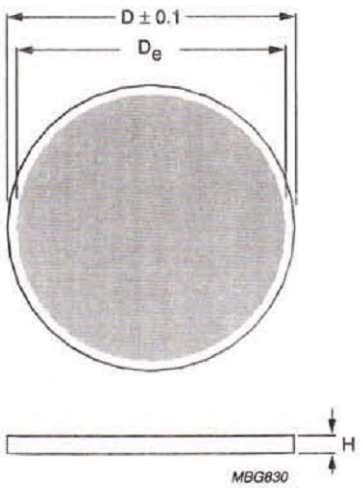
Fig.1 Disc with nickel electrode.

Disc data, nickel electrode; see Fig.1

GRADE	D (mm)	D_e (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	5	5.0 ±0.1	0.3 ±0.03	1220 ±25%	DSC5/0.3-PX5-N	17501
	5	5.0 ±0.1	0.5 ±0.03	750 ±25%	DSC5/0.5-PX5-N	17511
	5	5.0 ±0.1	1.0 ±0.03	375 ±25%	DSC5/1-PX5-N	17521
	5	5.0 ±0.1	2.0 ±0.1	185 ±25%	DSC5/2-PX5-N	17531
	10	9.0 ±0.3	0.2 ±0.03	5900 ±25%	DSC10/0.2-PX5-N	17541
	10	9.0 ±0.3	0.5 ±0.03	2360 ±25%	DSC10/0.5-PX5-N	17551
	10	9.3 ±0.3	1.0 ±0.03	1390 ±25%	DSC10/1-PX5-N	17561
	10	9.3 ±0.3	2.0 ±0.1	700 ±25%	DSC10/2-PX5-N	17571
	10	9.3 ±0.3	3.0 ±0.1	460 ±25%	DSC10/3-PX5-N	17581
	10	9.3 ±0.3	5.0 ±0.1	280 ±25%	DSC10/5-PX5-N	17591
	16	15.0 ±0.3	0.2 ±0.03	17000 ±25%	DSC16/0.2-PX5-N	17601
	16	15.3 ±0.3	0.5 ±0.03	6800 ±25%	DSC16/0.5-PX5-N	17611
	16	15.3 ±0.3	1.0 ±0.03	3620 ±25%	DSC16/1-PX5-N	17621
	16	15.3 ±0.3	2.0 ±0.1	1800 ±25%	DSC16/2-PX5-N	17631
	16	15.3 ±0.3	3.0 ±0.1	1200 ±25%	DSC16/3-PX5-N	17641
	20	19.0 ±0.3	0.2 ±0.03	27000 ±25%	DSC20/0.2-PX5-N	17651
	20	19.3 ±0.3	0.5 ±0.03	10800 ±25%	DSC20/0.5-PX5-N	17661
	20	19.3 ±0.3	1.0 ±0.03	5700 ±25%	DSC20/1-PX5-N	17671
	20	19.3 ±0.3	2.0 ±0.1	2850 ±25%	DSC20/2-PX5-N	17681
	25	24.0 ±0.3	0.2 ±0.03	42925 ±25%	DSC25/0.2-PX5-N	17691
	25	24.3 ±0.3	0.5 ±0.03	17200 ±25%	DSC25/0.5-PX5-N	17701
	25	24.3 ±0.3	1.0 ±0.03	9000 ±25%	DSC25/1-PX5-N	17711
	25	24.3 ±0.3	2.0 ±0.1	4500 ±25%	DSC25/2-PX5-N	17721

DISCS WITH SILVER ELECTRODES

Our standard range of discs with silver electrodes is available in grade PXE 5, PXE 41 and PXE 42. Other grades and sizes are available on request. The positive pole is marked.



Dimensions in mm.

Fig.2 Disc with silver electrode.

Disc data, silver electrode; see Fig.2

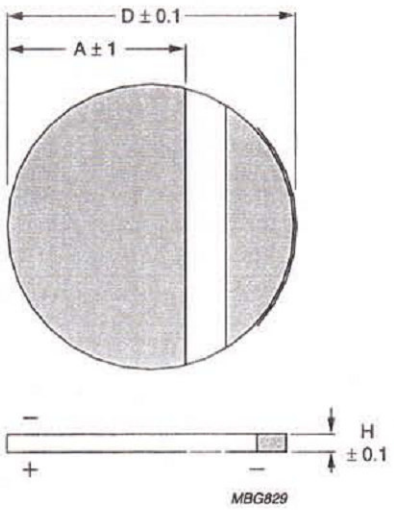
GRADE	D (mm)	D_e (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	5	=D	0.3 ±0.03	1220 ±25%	DSC5/0.3-PX5-S	17871
	5	=D	0.5 ±0.03	750 ±25%	DSC5/0.5-PX5-S	17881
	5	=D	1.0 ±0.03	375 ±25%	DSC5/1-PX5-S	17891
	5	=D	2.0 ±0.1	185 ±25%	DSC5/2-PX5-S	17901
	10	9 ±0.3	0.5 ±0.03	2360 ±25%	DSC10/0.5-PX5-S	17911
	10	=D	1.0 ±0.03	1460 ±25%	DSC10/1.0-PX5-S	02332
	10	=D	2.0 ±0.1	730 ±25%	DSC10/2-PX5-S	17921
	10	=D	3.0 ±0.1	490 ±25%	DSC10/3-PX5-S	05362
	10	=D	5.0 ±0.1	290 ±25%	DSC10/5-PX5-S	05372
	16	15 ±0.3	0.5 ±0.03	6800 ±25%	DSC16/0.5-PX5-S	17931
	16	=D	1.0 ±0.03	3735 ±25%	DSC16/1-PX5-S	02256
	25	24 ±0.3	0.5 ±0.03	17200 ±25%	DSC25/0.5-PX5-S	17851
	25	=D	1.0 ±0.03	9125 ±25%	DSC25/1-PX5-S	17411
	25	=D	2.0 ±0.1	4560 ±25%	DSC25/2-PX5-S	17861
PXE 41	31.75 ±0.5	–	≈14.3; note 1	650 ±25%	DSC32/14-PX41-S-T	05241
	25.4 ±0.5	–	≈10.2; note 2	550 ±25%	DSC25/10-PX41-S-T	05751
PXE 42	25.0 ±0.1	–	1 ±0.1	5750 ±25%	DSC25/1-PX42-S	17441
	25.0 ±0.1	–	2 ±0.1	2870 ±25%	DSC25/2-PX42-S	17451
	38.0 ±0.5	–	3 ±0.1	4430 ±25%	DSC38/3-PX42-S	17461
	38.0 ±0.5	–	6 ±0.1	2215 ±25%	DSC38/6-PX42-S	17471
	50.0 ±1.0	–	3 ±0.1	7670 ±25%	DSC50/3-PX42-S	17481
	50.0 ±1.0	–	6 ±0.1	3835 ±25%	DSC50/6-PX42-S	17491

Notes

1. Tuned for 151 kHz.
2. Tuned for 200 kHz.

DISCS WITH WRAP-AROUND ELECTRODES

These discs have provision for connecting both electrodes from one side by means of a wrap-around electrode as shown. They are therefore particularly suitable for bonding to flat substrates where electrical connection to both sides is difficult. The material is PXE 5, but other grades and sizes are available on request.



Dimensions in mm.

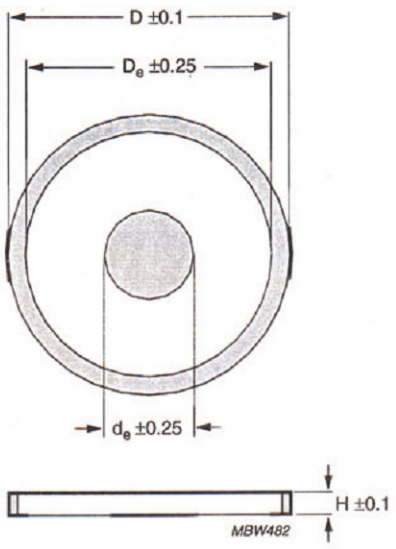
Fig.3 Disc with wrap-around electrode.

Disc data, wrap-around electrode; see Fig.3

GRADE	D (mm)	A (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	10	6.5	1	1000 ±25%	DSC10/1/WL-PX5-S	08421
	16	10	1	2600 ±25%	DSC16/1/WL-PX5-S	02274

DISCS WITH ROUND WRAP-AROUND ELECTRODES

These discs have provision for connecting both electrodes from one side by means of a wrap-around electrode as shown. They are therefore particularly suitable for bonding to flat substrates where electrical connections to both sides is difficult. The material is PXE 42, but other grades and sizes are available on request



Dimensions in mm.

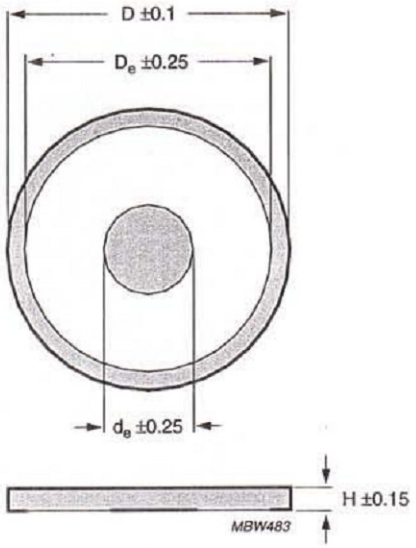
Fig.4 Disc with round, silver wrap-around electrode.

Disc data, round silver wrap-around electrode; see Fig.4

GRADE	D (mm)	D_e (mm)	d_e (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 42	20	17	7	0.85	730 ±20%	DSC20/0.9/WR-PX42-S	02351
	20	17	7	1.2	520 ±20%	DSC20/1.2/WR-PX42-S	17961

DISCS WITH ROUND WRAP-AROUND ELECTRODES

These discs have provision for connecting both electrodes from one side by means of a wrap around electrode as shown. They are therefore particularly suitable for bonding to flat substrates where electrical connections to both sides is difficult. The material is PXE 5, but other grades and sizes are available on request



Dimensions in mm.

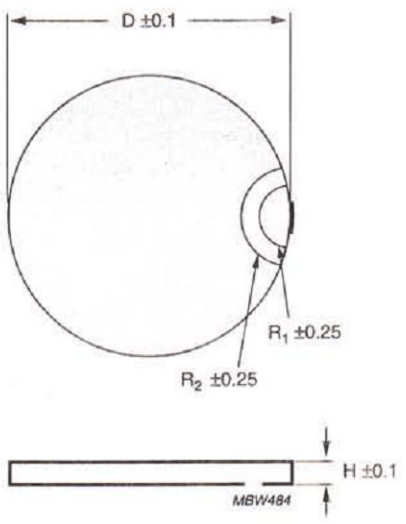
Fig.5 Disc with round, nickel + gold flash wrap-around electrode.

Disc data, round nickel + gold flash wrap-around electrode; see Fig.5

GRADE	D (mm)	D_e (mm)	d_e (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	16	14	7	2	490 ±20%	DSC16/2/WR-PX5-NG	04051
	25	23	8	2	640 ±20%	DSC25/2/WR-PX5-NG	04011
	25.4	23	8	2	640 ±20%	DSC25.4/2/WR-PX5-NG	16531

DISCS WITH CIRCULAR WRAP-AROUND ELECTRODES

These discs have provision for connecting both electrodes from one side by means of a wrap around electrode as shown. They are therefore particularly suitable for bonding to flat substrates where electrical connections to both sides is difficult. The material is PXE 5, but other grades and sizes are available on request



Dimensions in mm.

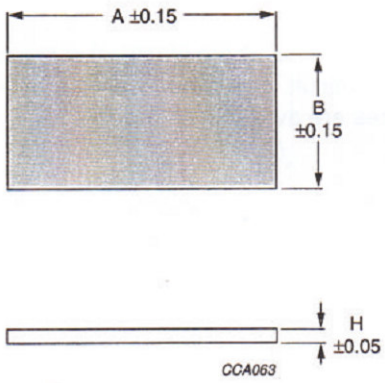
Fig.6 Disc with circular, silver wrap-around electrode.

Disc data, circular silver wrap-around electrode; see Fig.6

GRADE	D (mm)	R_1 (mm)	R_2 (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	16	2.5	3.5	1	3350 ±25%	DSC16/1/WC-PX5-S	17941
	20	3	4	1	5230 ±25%	DSC20/1/WC-PX5-S	04031
	25	3	4	1	8200 ±25%	DSC25/1/WC-PX5-S	04041

SQUARE AND RECTANGULAR PLATES

The material grade in the following two tables is PXE 5, but other grades and sizes are available on request (any thickness between 0.2 and 3.0 mm is possible). The positive pole is marked.



Dimensions in mm.

Fig.1 Plate.

Plate data, nickel electrode; see Fig.1

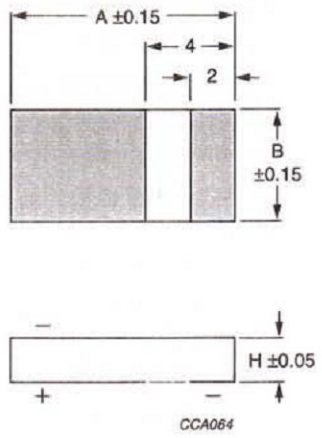
GRADE	A (mm)	B (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	4	4	0.3	990 ±20%	PLT4/4/0.3-PX5-N	13501
	8	4	0.3	1980 ±20%	PLT8/4/0.3-PX5-N	13521
	12	4	0.3	2970 ±20%	PLT12/4/0.3-PX5-N	13541
	6	6	0.3	2230 ±20%	PLT6/6/0.3-PX5-N	13551
	12	6	0.3	4460 ±20%	PLT12/6/0.3-PX5-N	13581
	8	8	0.3	3960 ±20%	PLT8/8/0.3-PX5-N	13591
	10	10	0.3	6200 ±20%	PLT10/10/0.3-PX5-N	13621
	12	12	0.3	8920 ±20%	PLT12/12/0.3-PX5-N	13641
	12	6	0.5	2670 ±20%	PLT12/6/0.5-PX5-N	13651
	12	6	1.0	1340 ±20%	PLT12/6/1.0-PX5-N	13661

Plate data, silver electrode; see Fig.1

GRADE	A (mm)	B (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	16	12	1	3500 ±20%	PLT16/12/1-PX5-S	02311
	12	6	0.5	2670 ±20%	PLT12/6/0.5-PX5-S	07051
	12	6	1	1340 ±20%	PLT12/6/1-PX5-S	07061
	12	6	1.25	1070 ±20%	PLT12/6/1.3-PX5-S	07291

PLATES WITH WRAP-AROUND ELECTRODES

These plates have provision for connecting both electrodes from one side by means of a wrap-around electrode as shown. They are therefore particularly suitable for bonding to flat substrates where electrical connection to both sides is difficult. The material is PXE 5, but other grades and sizes are available on request.



Dimensions in mm.

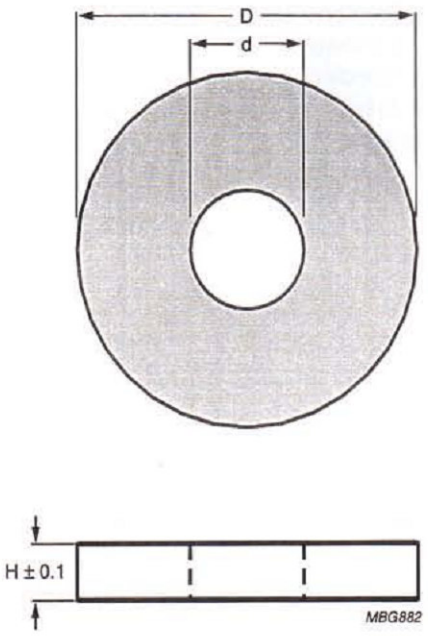
Fig.2 Plate with wrap-around electrode.

Plate data, silver electrode; see Fig.2

GRADE	A (mm)	B (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
PXE 5	10	4	1	480 ±25%	PLT10/4/1/W-PX5-S	13681
	10	4	2	240 ±25%	PLT10/4/2/W-PX5-S	13691
	10	5	1	600 ±25%	PLT10/5/1/W-PX5-S	13701
	10	5	2	300 ±25%	PLT10/5/2/W-PX5-S	13711
	15	5	2	550 ±25%	PLT15/5/2/W-PX5-S	13721

RINGS

Our standard range of rings has silver electrodes. The polarization is axial and the positive electrode is marked. Other sizes and grades are available on request.



Dimensions in mm.

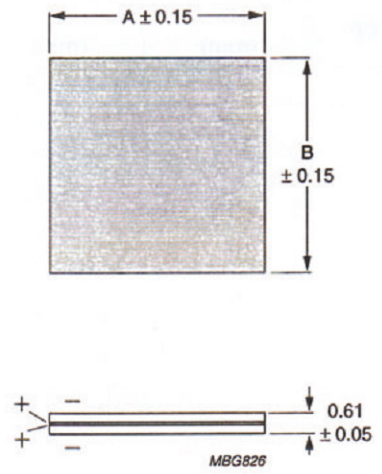
Fig.1 Ring.

Ring data, silver electrode; see Fig.1

GRADE	D (mm)	d (mm)	H (mm)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 ...
PXE 5	10 ±0.1	5.0 ±0.15	2	550 ±25%	RNG10/5/2-PX5-S	06571
PXE 59	12 ±0.1	6.0 ±0.15	1	1200 ±25%	RNG12/6/1-PX59-S	06791
	12 ±0.1	6.0 ±0.15	1.5	865 ±25%	RNG12/6/1.5-PX59-S	06781
PXE 42	10 ±0.1	5.0 ±0.15	2	340 ±25%	RNG10/5/2-PX42-S	06661
	15 ±0.1	6.0 ±0.15	3	580 ±25%	RNG15/6/3-PX42-S	06471
	15 ±0.1	8.0 ±0.15	2	740 ±25%	RNG15/8/2-PX42-S	06671
	20 ±0.4	6.0 ±0.15	5	670 ±25%	RNG20/6/5-PX42-S	06131
	25 ±0.5	10.0 ±0.2	4	1200 ±25%	RNG25/10/4-PX42-S	06681
	25 ±0.5	10.0 ±0.2	5	965 ±25%	RNG25/10/5-PX42-S	06691
	25 ±0.5	10.0 ±0.2	6	800 ±25%	RNG25/10/6-PX42-S	06701
	38 ±0.6	12.7 ±0.3	4	2950 ±25%	RNG38/13/4-PX42-S	06091
	38 ±0.6	12.7 ±0.3	6	1970 ±25%	RNG38/13/6-PX42-S	06711
	38 ±0.6	12.7 ±0.3	6.35	1870 ±25%	RNG38/13/6-PX42-S	06042
	38 ±0.6	19.0 ±0.4	4	2490 ±25%	RNG38/19/4-PX42-S	06721
	38 ±0.6	19.0 ±0.4	6.35	1570 ±25%	RNG38/19/6-PX42-S	06072
	50 ±1.0	20.0 ±0.4	5	3865 ±25%	RNG50/20/5-PX42-S	06731
	50 ±1.0	20.0 ±0.4	6	3220 ±25%	RNG50/20/6-PX42-S	06051
	50 ±1.0	20.0 ±0.4	6.35	3040 ±25%	RNG50/20/6.4-PX42-S	06101
PXE 43	10 ±0.1	5.0 ±0.15	2	260 ±25%	RNG10/5/2-PX43-S	06591
	15 ±0.1	8.0 ±0.15	2	530 ±25%	RNG15/8/2-PX43-S	06601
	20 ±0.4	6.0 ±0.15	5	500 ±25%	RNG20/6/5-PX43-S	06291
	25 ±0.5	10.0 ±0.2	4	910 ±25%	RNG25/10/4-PX43-S	06611
	25 ±0.5	10.0 ±0.2	5	730 ±25%	RNG25/10/5-PX43-S	06281
	25 ±0.5	10.0 ±0.2	6	610 ±25%	RNG25/10/6-PX43-S	06621
	38 ±0.6	12.7 ±0.3	4	2220 ±25%	RNG38/13/4-PX43-S	06631
	38 ±0.6	12.7 ±0.3	6	1480 ±25%	RNG38/13/6-PX43-S	06641
	38 ±0.6	12.7 ±0.3	6.35	1400 ±25%	RNG38/13/6.4-PX43-S	06261
	50 ±1.0	20.0 ±0.5	5	2910 ±25%	RNG50/20/5-PX43-S	06153
	50 ±1.0	20.0 ±0.5	6	2425 ±25%	RNG50/20/6-PX43-S	06142

SERIES BIMORPH ELEMENTS

A range of square and rectangular bimorphs in grade PXE 5 for use in record players, accelerometers, detection systems in machinery, medical equipment and air transducers. The electrodes are nickel-plated. Series bimorphs are not recommended for use as actuators.



Dimensions in mm.

Fig.1 Series bimorphs.

Bimorph data, nickel electrode; see Fig.1

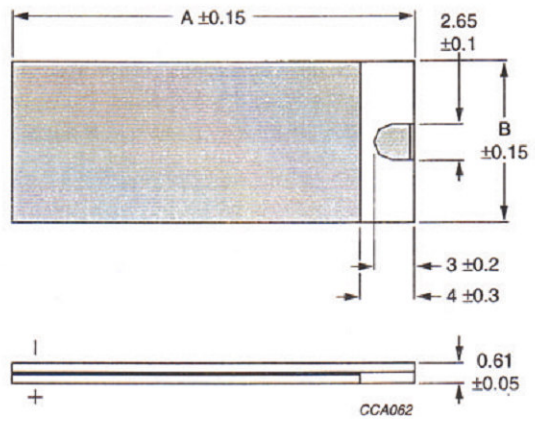
A (mm) (note 1)	B (mm) (note 1)	CAPACITANCE (pF)	TYPE NUMBER	4322 020 .....
4.0	4.0	420 ±20%	BIMS4/4/0.6-PX5-N	04571
6.0	4.0	630 ±20%	BIMS6/4/0.6-PX5-N	04581
8.0	4.0	840 ±20%	BIMS8/4/0.6-PX5-N	04591
10.0	4.0	1050 ±20%	BIMS10/4/0.6-PX5-N	04601
12.0	4.0	1250 ±20%	BIMS12/4/0.6-PX5-N	04611
6.0	6.0	950 ±20%	BIMS6/6/0.6-PX5-N	04621
8.0	6.0	1250 ±20%	BIMS8/6/0.6-PX5-N	04631
10.0	6.0	1600 ±20%	BIMS10/6/0.6-PX5-N	04641
12.0	6.0	1900 ±20%	BIMS12/6/0.6-PX5-N	04651
8.0	8.0	1700 ±20%	BIMS8/8/0.6-PX5-N	04661
10.0	8.0	2100 ±20%	BIMS10/8/0.6-PX5-N	04671
12.0	8.0	2550 ±20%	BIMS12/8/0.6-PX5-N	04681
10.0	10.0	2650 ±20%	BIMS10/10/0.6-PX5-N	04691
12.0	10.0	3150 ±20%	BIMS12/10/0.6-PX5-N	04701
12.0	12.0	3800 ±20%	BIMS12/12/0.6-PX5-N	04711
12.7	1.6	535 ±20%	BIMS13/1.6/0.6-PX5-N	08251
15.5	1.6	650 ±20%	BIMS16/1.6/0.6-PX5-N	08241
70.0	1.6	3000 ±20%	BIMS70/1.6/0.6-PX5-N	08231

Note

1. Other sizes are available on request.

PARALLEL BIMORPH ELEMENTS

A range of rectangular parallel bimorph elements in grade PXE 5. The electrodes are nickel-plated and the inner electrode is accessible through a small cut-out in the upper plate. Parallel bimorphs are especially recommended for use as actuators.



Dimensions in mm.

Fig.1 Parallel bimorph.

Bimorph data, nickel electrode; see Fig.1

A (mm) (note 1)	B (mm) (note 1)	CAPACITANCE (pF) (note 2)	F_r MIN. (Hz)	DEFLECTION (μm) (notes 3 and 4)	TYPE NUMBER	4322 020 .....
15	6	9000	2200	95 ±20%	BIMP15/6/0.6-PX5-N	14532
20	6	13000	1000	225 ±20%	BIMP20/6/0.6-PX5-N	14542
25	6	16500	500	400 ±20%	BIMP25/6/0.6-PX5-N	14552
30	6	20000	350	640 ±20%	BIMP30/6/0.6-PX5-N	14562
35	6	24000	240	935 ±20%	BIMP35/6/0.6-PX5-N	14572
15	12	18000	2200	95 ±20%	BIMP15/12/0.6-PX5-N	14582
20	12	25000	1000	225 ±20%	BIMP20/12/0.6-PX5-N	14592
25	12	33000	500	400 ±20%	BIMP25/12/0.6-PX5-N	14602
30	12	40000	350	640 ±20%	BIMP30/12/0.6-PX5-N	14612
35	12	48000	240	935 ±20%	BIMP35/12/0.6-PX5-N	14622

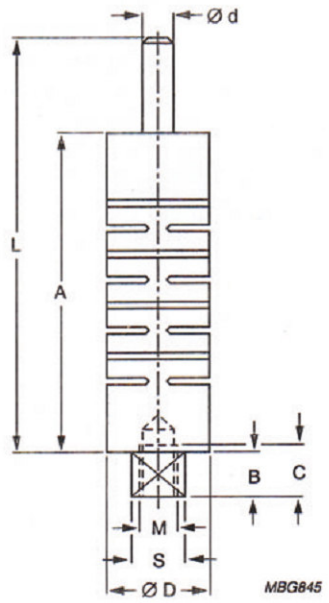
Notes

1. Other sizes are available on request.
2. The capacitance between the central electrode and the interconnected outer electrodes.
3. Deflection peak-to-peak at 300 V peak-to-peak (±150 V) with free length is A – 5 mm.
4. Bimorph not mechanically loaded.

HIGH-POWER ACTUATORS

The high-power actuator produces in the 33 mode, displacements far greater than those possible with simple PXE transducers operating in the 31 or 33 modes. It comprises of a pile of PXE discs interleaved with copper foil electrodes and held in compression with a force of approximately 1000 N by a cylindrical steel spring. The high compressive forces give the structure exceptional rigidity by eliminating all free play between the discs.

A voltage between the electrodes causes the discs to expand, stretching the cylindrical spring and producing an overall extension of the actuator. The actuator has a response time of approximately 200 μs.



For dimensions see Table 1.

Fig.1 High-power actuator.

Table 1 Ordering codes and relevant physical dimensions; see Fig.1

PARAMETER	ORDERING CODE			UNIT
	HPA 16/50-PX52	HPA 22/75-PX52	HPA 30/100-PX52	
	4322 020 19051	4322 020 19061	4322 020 19071	
A	50 +0.5	75 +0.7	100 +1	mm
B	±0.25	8 ±0.25	10 ±0.25	mm
C	±1	9 ±1	10 ±1	mm
D	±0.1	22 ±0.1	30 ±0.1	mm
M	× 0.75	M 8 × 1	M 12 × 1	mm
L	±2	104 ±2	130 ±2	mm
d	5 h 6	8 h 6	10 h 6	mm
s	8	12	17	mm
Stroke 0 to 500 V	≈20	≈30	≈50	μm
Stroke 0 to 800 V	≈35	≈50	≈80	μm
Capacitance at 25 °C	≈100	≈250	≈800	nF
Stiffness	≈30	≈50	≈80	N/μm
Maximum loading force	2000	3000	5000	N
Mass	60	140	440	g
Spring stiffness	≈3	3	3	N/μm

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