

PCBMotor ApS – Datasheet Lead Free PZT – 2025

Properties of lead-free piezoelectric ceramics
—Lead-free piezoelectric material

NO.	Property	Symbol	BT-01	BNT-01	KNN-15
1	Coupling Coefficients	k_r	0.36	0.12	0.48
		k_{31}	0.21	0.07	0.28
		k_{33}	0.51	0.44	0.55
		k_t	0.39	0.44	0.39
2	Dielectric constant (1kHz)	ϵ	1430	510	1600
		ϵ	1320	430	1450
3	Poisson's ratio	σ	0.33	0.26	0.39
4	Dielectric Loss Factor (1kHz)	$\text{tg } \delta$	0.008	0.008	0.050
5	Elastic Constants ($\times 10^{-12} \text{m}^2/\text{N}$)	S_{11}^E	7.8	8.0	10.4
		S_{12}^E	-2.5	-2.9	-3.3
		S_{13}^E	8.3	9.0	10.2
		S_{11}^D	7.4	8.9	9.6
		S_{11}^{ν}	6.1	7.2	7.8
		S_{55}^D	15.5	18.1	19.5
6	Piezoelectric Charge (Displacement Coefficients) ($\times 10^{-12} \text{C}/\text{N}$)	d_{15}	245	82	375
		d_{31}	-65	-14	-105
		d	180	100	270
7	Piezoelectric voltage Constants ($\times 10^{-3} \text{V}\cdot\text{m}/\text{N}$)	g_{31}	-5.3	-3.0	-7.3
		g_{33}	12.6	20.1	30.0
		g_{15}	17.2	20.6	22.2
8	Mechanical Quality Factor	Q_M	120	720	50
9	Frequency Constants ($\text{Hz}\cdot\text{m}$)	N_d	3250	3050	3180
		N_1	2350	2200	2300
		N_3	2640	2450	/
		N_s	1680	1550	1600
		N	2930	2610	3160
10	Poisson's ratio	σ	0.33	0.26	0.39
11	Density ($\times 10^3 \text{kg}/\text{m}^3$)	ρ	5.80	5.70	4.50
12	Curie Point ($^{\circ}\text{C}$)	T_c	130	255	330
13	The relative change rate of temperature (%) ($-10 \sim +25^{\circ}\text{C}$, $+25^{\circ}\text{C}$ $\sim +50^{\circ}\text{C}$)	$\Delta N_d/N$	/	/	8.5
		$\Delta \epsilon / \epsilon$	/	/	12