



Таблицы характеристик материалов для твердых, мягких и РТ/ВТ/РН изделий из PZT

Серии	Код товара	PT		PN			PZT Hard										PZT Soft									
		PT-1	BT-1	PN-1	PN-2	PN-3	P-4A	P-4B	P-4C	P-8A	P-8B	P-4D	P-4E	P-4F	P-4G	P-5A	P-5B	P-5C	P-5D	P-5E	P-5H	P-5HD	P-5X	P-5XD		
Диэлектрические свойства	$\epsilon_{33}^T/\epsilon_0$	220	1100	180	370	750	390	590	750	1050	1190	1350	1540	1490	1610	1800	1950	2340	2950	3240	3650	3860	4100	4600		
	$\epsilon_{33}^S/\epsilon_0$	160	880	130	320	590	240	360	430	610	690	730	820	750	840	910	960	1140	1300	1480	1690	1660	1880	1710		
	$\epsilon_{11}^T/\epsilon_0$	240	1280	270	340	620	830	1120	1080	1360	1540	1470	1660	1910	1680	1710	1780	2300	2810	3350	3280	3490	3770	3680		
	$\epsilon_{11}^S/\epsilon_0$	220	990	250	320	550	480	610	610	830	890	750	860	920	980	940	870	1210	1340	1470	1680	1600	1900	1660		
	tg δ (low field)	%	1	0.5	2	0.8	1.5	0.3	0.3	0.4	0.3	0.2	0.5	0.4	0.5	0.5	2	2	1.5	1.5	2	1.5	1.5	2	2	
Физические свойства	ρ	g/cm ³	7.6	5.7	4.6	6.1	5.7	7.7	7.7	7.7	7.6	7.7	7.6	7.8	7.8	7.7	7.7	7.8	7.7	7.8	7.8	7.6	7.8	7.8	7.9	
	T _c	°C	380	120	280	460	320	320	320	340	310	325	325	310	315	295	360	360	290	260	270	225	230	215	205	
	Z _a	Mrayl	32	29	26	20	17	29	29	28	28	28	26	26	27	27	23	25	24	23	25	23	24	23	23	
	V ₁	mS	4270	4830	4870	2610	2840	3620	3670	3260	3470	3530	3260	3250	3390	3340	2860	2920	2890	2890	2850	2820	2750	2840	2920	
	V ₃	mS	4660	5270	3840	3330	3060	4090	4080	3860	4130	4120	4430	4350	4070	4040	3630	3740	3780	3790	4140	3650	3890	3720	3810	
	V _d	mS	4150	5050	5630	3190	3010	3750	3740	3620	3640	3630	3380	3350	3410	3450	3030	3200	3110	2990	3130	3010	3060	2950	2970	
	V _t	mS	4850	5860	6170	3550	3460	4740	4950	4830	4780	4800	4620	4660	4730	4650	4480	4730	4600	4600	4780	4440	4630	4340	4480	
	V _s	mS	2950	3660	3600	2000	2030	2540	2690	2880	2480	2540	3350	3190	2590	2580	2260	2340	2480	2500	2940	2380	2590	2470	2540	
	Пьезоэлектрические свойства	K _p		0.05	0.3	0.09	0.26	0.29	0.45	0.5	0.52	0.52	0.55	0.58	0.6	0.6	0.6	0.61	0.62	0.64	0.68	0.66	0.68	0.67	0.7	
K ₃₃			0.51	0.45	0.48	0.37	0.46	0.62	0.62	0.65	0.65	0.68	0.68	0.71	0.69	0.7	0.71	0.72	0.75	0.74	0.73	0.75	0.73	0.74		
K _t			0.48	0.4	0.43	0.35	0.38	0.48	0.48	0.48	0.5	0.49	0.51	0.47	0.49	0.48	0.48	0.51	0.51	0.52	0.5	0.53	0.53	0.55		
K ₃₁			0.1	0.19	0.06	0.07	0.19	0.26	0.3	0.31	0.32	0.34	0.35	0.4	0.37	0.36	0.38	0.38	0.38	0.39	0.39	0.42	0.38	0.41		
K ₁₅			0.31	0.48	0.26	0.22	0.34	0.65	0.67	0.66	0.62	0.65	0.7	0.69	0.72	0.65	0.67	0.71	0.69	0.72	0.75	0.7	0.74	0.7		
N _p		Hz-m	2710	3290	3670	2080	1960	2440	2440	2360	2370	2370	2200	2180	2220	2250	2010	2080	2070	1990	2040	1960	1990	1920	1990	
N ₃₃		Hz-m	2050	2400	1720	1560	1380	1660	1660	1530	1640	1630	1710	1670	1520	1530	1360	1380	1390	1340	1490	1320	1360	1340	1460	
N _t		Hz-m	2170	2730	2830	1680	1620	2120	2220	2160	2140	2130	2050	2050	2120	2070	2010	2120	2020	2030	2100	1970	2010	1890	2100	
N ₁₅		Hz-m	1410	1640	1750	980	960	1010	1040	1130	1010	1010	1250	1200	940	1020	870	860	940	900	1030	890	920	920	1070	
N ₃₁		Hz-m	2130	2410	2430	1300	1420	1810	1830	1630	1730	1760	1630	1620	1690	1670	1430	1460	1440	1440	1420	1410	1370	1420	1310	
d ₃₃		pC/N	68	135	60	93	190	145	180	220	240	260	310	350	350	340	400	430	470	580	580	640	680	700	730	
d ₃₁		pC/N	-12	-53	-7	-20	-72	-51	-69	-90	-110	-110	-140	-150	-160	-150	-180	-200	-220	-250	-270	-290	-300	-300	-310	
d ₁₅		pC/N	59	207	55	79	177	320	380	330	400	440	380	410	580	450	550	610	610	740	740	780	840	830	805	
d _h		pC/N	45	29	40	53	47	45	42	40	45	46	46	61	44	46	40	37	37	94	47	68	38	115	90	
g ₃₃		10 ⁻³ Vm/N	34.8	13.8	37.4	27.8	28.5	41.6	33.9	32.9	26.5	24.6	25.8	25.6	26.4	24.1	25.1	24.9	22.7	22.2	20.2	19.8	19.9	19.3	17.9	
g ₃₁		10 ⁻³ Vm/N	-5.9	-5.4	-4.2	-5.9	-10.6	-13.5	-13.1	-13.3	-10.8	-11	-11	-10.5	-11.7	-10.5	-11.4	-11.3	-10.5	-9.2	-9.2	-8.8	-9.4	-8.1	-7.9	
g ₁₅		10 ⁻³ Vm/N	27.5	18.3	22.3	26.3	32	44.1	39	35.2	33.4	32.5	29.4	28.1	34.7	30.5	36.7	39	30.3	30	25.2	27.1	27.3	24.9	24.7	
g _h		10 ⁻³ Vm/N	23.3	3	29.1	16	7.1	12.9	8	6	4.9	4.4	3.9	4.5	3.4	3.2	2.6	2.2	1.8	3.6	1.7	2.1	1.1	3.2	2.1	
e ₃₁		C/m ²	1.4	-3.5	2.4	0.7	-0.8	-0.1	-1.6	-2	-3.5	-4.3	-5.2	-5.9	-10.5	-7.5	-7.1	-9.9	-9.6	-10.8	-8.4	-8.5	-11.9	-7.5	-11.5	
e ₃₃	C/m ²	8.1	12.4	7.7	5.4	6.9	11.3	10.1	11.5	13.1	14	13.9	14	11.3	14.4	14.3	12.9	15.3	17.5	20.2	20.6	19	22.5	21.4		
e ₁₅	C/m ²	3.6	12.3	3.1	1.8	3.7	9.5	11.7	12.3	11.6	12.9	16.7	17.1	14.9	13.7	12.2	13	15.5	17.4	22.2	18	19.8	19.9	21.7		
h ₃₁	10 ⁶ V/m	9.6	-4.5	19.6	2.5	-1.5	-0.4	-4.8	-5.1	-6.5	-7.1	-8	-8	-15.8	-10	-8.8	-11.6	-9.5	-9.4	-6.4	-5.6	-8.1	-4.5	-6.8		
h ₃₃	10 ⁶ V/m	56	15.8	62.8	18.9	13.1	52.9	31	29.9	24	22.9	21.4	19	17	19.3	17.8	15.1	15.2	15.2	15.3	13.7	12.9	13.4	12.1		
h ₁₅	10 ⁶ V/m	18.3	14.1	13.3	6.4	7.6	22	21.6	22.5	15.7	16.2	25.2	22.3	18.3	15.7	14.5	16.8	14.4	14.7	17.1	12.1	14	11.8	15.1		

Код товара		PT-1	BT-1	PN-1	PN-2	PN-3	P-4A	P-4B	P-4C	P-8A	P-8B	P-4D	P-4E	P-4F	P-4G	P-5A	P-5B	P-5C	P-5D	P-5E	P-5H	P-5HD	P-5X	P-5XD		
		Qpm	500				1400	1300	1200	1000	1000	500	1000	1500	1800	85	90	80	80	85	75	65	65	60		
	Qtm (varies with fr)	650	350	650	14	15	420	350	350	350	300	250	350	600	650	30	30	30	30	30	25	20	20	20		
Эластичные свойства	S ₃₃ ^E	10 ¹² m ² /N	9.2	9.3	9.7	18.7	25.5	12.8	16	16.9	15.9	15.2	17.5	19.3	18.8	17.5	20.4	21.1	20.9	23	21.6	23.5	23.8	25	23.9	
	S ₁₁ ^E	10 ¹² m ² /N	7.2	7.5	9.1	24.4	21.8	10.2	9.8	12.2	10.9	10.4	12.4	12.1	11.1	11.6	15.8	15	15.7	15.3	15.8	16.5	16.8	16	15.1	
	S ₁₂ ^E	10 ¹² m ² /N	-1.4	-2.5	-1.8	-5.4	-5.1	-2.9	-2.7	-3.8	-3.3	-3	-4	-3.9	-3.6	-3.6	-6	-5.6	-5.8	-6.2	-5	-5	-5.1	-4.8	-4.7	
	S ₁₃ ^E	10 ¹² m ² /N	-2.4	-2.8	-3.1	-6.1	-8.4	-4.4	-5.7	-6.3	-5.7	-5.3	-6.3	-6.9	-6.5	-6.2	-7.7	-8	-7.9	-8.2	-8.7	-9.2	-9.5	-9.3	-9.2	
	S ₅₅ ^E	10 ¹² m ² /N	16.7	16.9	18	43.1	47.9	34.5	33.2	27.5	34.7	34.5	22.9	24.2	39.4	33.3	45.8	47.2	39.7	42.9	33.7	43.9	42.5	41.8	36.3	
	S ₆₆ ^E	10 ¹² m ² /N	17.2	19.9	21.8	59.6	53.7	26.1	24.9	32	28.4	26.9	32.8	32	29.5	30.3	43.5	41.4	43	43.1	41.6	43	43.9	41.7	39.6	
	S ₃₃ ^D	10 ¹² m ² /N	6.8	7.4	7.5	16.1	20.2	7.8	9.8	9.8	9.3	8.8	9.5	10.3	9.5	9.2	10.3	10.4	10.1	10.1	9.9	10.9	10.3	11.5	10.8	
	S ₁₁ ^D	10 ¹² m ² /N	7.1	7.2	9.1	24.3	21	9.5	8.9	11	9.8	9.2	11	10.6	9.4	10	13.8	12.8	13.5	13.1	13.4	14	13.8	13.7	12.5	
	S ₁₂ ^D	10 ¹² m ² /N	-1.5	-2.8	-1.8	-5.5	-5.8	-3.6	-3.6	-5	-4.4	-4.2	-5.4	-5.4	-5.4	-5.1	-8	-7.9	-8	-8.4	-7.4	-7.6	-8.1	-7.2	-7.2	
	S ₁₃ ^D	10 ¹² m ² /N	-2	-2.1	-2.9	-5.6	-6.4	-2.4	-3.3	-3.4	-3	-2.5	-2.9	-3.2	-2.5	-2.6	-3.1	-3.1	-3	-2.9	-3.3	-3.5	-3.2	-3.6	-3.5	
	S ₅₅ ^D	10 ¹² m ² /N	15	13	16.7	41	42.2	20	18.1	15.6	21.3	20	11.7	12.6	19	19.4	25.4	23.2	21	20.4	14.8	22.5	19.5	21.1	16.4	
	S ₆₆ ^D	10 ¹² m ² /N	17.2	19.9	21.8	59.6	53.7	26.1	24.9	32	28.4	26.9	32.8	32	29.5	30.3	43.5	41.4	43	43.1	41.6	43	43.9	41.7	39.4	
	C ₃₃ ^E	10 ¹⁹ N/m ²	13.8	16.4	14.3	6.8	5.8	13.3	14.5	13.7	13.3	13.4	12.3	12.6	13.5	12.6	11.9	13.5	12.1	12.3	13.1	11.3	12.1	10.5	13.1	
	C ₁₁ ^E	10 ¹⁹ N/m ²	16.8	20.3	14.1	5	6.3	15.5	20.4	16.9	17.4	17.5	15.8	17.9	20.3	17	14.6	17.6	14.9	17.7	15.4	14	14.6	14.1	17.6	
	C ₁₂ ^E	10 ¹⁹ N/m ²	5.2	10.2	4.9	1.6	2.6	7.8	12.4	10.7	10.4	10.1	9.7	11.6	13.6	10.4	10	12.7	10.3	13.1	10.6	9.3	10	9.3	12.5	
	C ₁₃ ^E	10 ¹⁹ N/m ²	5.7	9.3	6.1	2.2	2.9	8	11.7	10.4	9.9	9.7	9.2	10.5	11.8	9.7	9.3	11.5	9.6	11	10.5	9.1	9.8	8.7	11.6	
	C ₅₅ ^E	10 ¹⁹ N/m ²	6	5.9	5.6	2.3	2.1	2.9	3	3.6	2.9	2.9	4.4	4.1	2.5	3	2.2	2.1	2.5	2.3	3	2.3	2.4	2.4	2.7	
	C ₆₆ ^E	10 ¹⁹ N/m ²	5.8	5	4.6	1.7	1.9	3.8	4	3.1	3.5	3.7	3.1	3.1	3.4	3.3	2.3	2.4	2.3	2.3	2.4	2.3	2.3	2.4	2.5	
	C ₃₃ ^D	10 ¹⁹ N/m ²	18	19.5	17.5	7.7	6.8	17.4	18.8	17.9	17.4	17.8	16.2	17	17.4	16.7	15.5	17.5	16.3	16.6	17.9	15	16.8	14.5	16.2	
	C ₁₁ ^D	10 ¹⁹ N/m ²	17	20.4	14.6	5	6.3	15.5	20.5	17	17.7	17.8	16.2	18.3	22	17.8	15.2	18.7	15.9	18.7	15.9	14.5	15.5	14.4	19	
	C ₁₂ ^D	10 ¹⁹ N/m ²	5.4	10.4	5.4	1.7	2.6	7.8	12.5	10.8	10.6	10.4	10.1	12.1	15.2	11.2	10.6	13.9	11.2	14.1	11.1	9.8	11	9.6	13.9	
	C ₁₃ ^D	10 ¹⁹ N/m ²	6.5	8.7	7.7	2.3	2.8	8	11.2	9.8	9.1	8.7	8.1	9.3	10	8.3	8	10	8.1	9.4	9.2	7.9	8.3	7.7	10.7	
	C ₅₅ ^D	10 ¹⁹ N/m ²	6.6	7.7	6	2.4	2.4	5	5.5	6.4	4.7	5	8.6	8	5.3	5.2	3.9	4.3	4.8	4.9	6.8	4.5	5.1	4.7	6.1	
	C ₆₆ ^D	10 ¹⁹ N/m ²	5.8	5	4.6	1.7	1.9	3.8	4	3.1	3.5	3.7	3.1	3.1	3.4	3.3	2.3	2.4	2.3	2.3	2.4	2.3	2.3	2.4	2.5	
	Y ₃₃ ^E	10 ¹⁹ N/m ²	10.9	10.7	10.3	5.3	3.9	7.8	6.3	5.9	6.3	6.6	5.7	5.2	5.3	5.7	4.9	4.7	4.8	4.4	4.6	4.3	4.2	4	4.2	
	Y ₁₁ ^E	10 ¹⁹ N/m ²	13.9	13.4	11	4.1	4.6	9.8	10.2	8.2	9.2	9.6	8.1	8.3	9	8.6	6.3	6.7	6.4	6.5	6.3	6.1	5.9	6.2	6.6	
	Y ₃₃ ^D	10 ¹⁹ N/m ²	14.7	13.4	13.4	6.2	4.9	12.8	10.2	10.3	10.8	11.3	10.5	9.7	10.6	10.9	9.7	9.6	9.9	9.9	10.1	9.2	9.7	8.7	9.2	
	Y ₁₁ ^D	10 ¹⁹ N/m ²	14	13.9	11	4.1	4.8	10.5	11.3	9.1	10.2	10.8	9.1	9.4	10.7	10	7.3	7.8	7.4	7.6	7.5	7.2	7.2	7.3	8	
		Poisson's Ratio	0.2	0.33	0.2	0.22	0.23	0.28	0.27	0.31	0.3	0.29	0.32	0.32	0.33	0.31	0.38	0.38	0.37	0.4	0.31	0.31	0.3	0.3	0.31	
	Стабильность во времени	ε ₃₃ ^T (% Per Decade)	0.8	-1.5	-1	-1	-1.7	-2.6	-2.9	-2.8	-3.1	-3.4	-3.2	-2.5	-2.6	-2.8	-0.8	-1.3	-1.6	-1.9	-1.9	-2	-2.2	-2.3	-2.4	
		Kp (% Per Decade)		-1.8				-1	-1.2	-1.1	-1.2	-1.3	-1.5	-1.1	-1.2	-1.3	-0.1	-0.4	-0.5	-0.5	-0.6	-0.6	-0.5	0.5	0.5	
		Kt (% Per Decade)	-0.3		0.4	0.2	0.3																			
		Np (% Per Decade)		0.4					-0.6	0.7	0.6	0.6	0.8	0.7	0.6	0.7	0.6	0.1	0.2	0.4	0.4	0.4	0.5	0.4	0.4	0.4
	Nt (% Per Decade)	0.2		0.3	0.3	0.3																				
Стабильность температуры	ε ₃₃ ^T (/°C) (-20 to 125 °C)	1.8		1.8	1.6	2.2	4	5	6	7	7	5	7	8	8	5	4.5	8								
	ε ₃₃ ^T (/°C) (-20 to 85 °C)		3.1																9	10	12	14	17	18		