



Leadfree Piezoceramic Materials

CA220108/EN/Z312/IM

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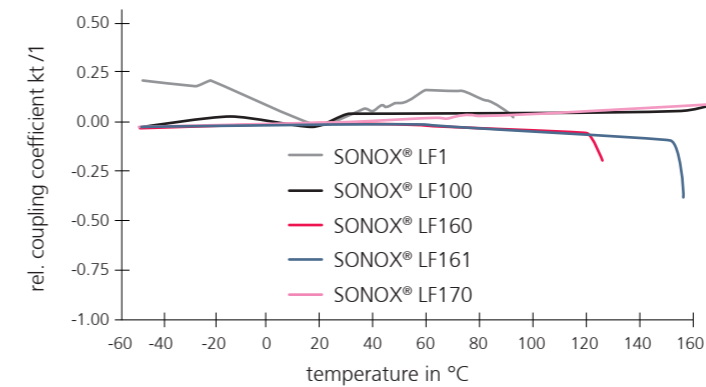


Material Characteristics (preliminary Data Sheet)

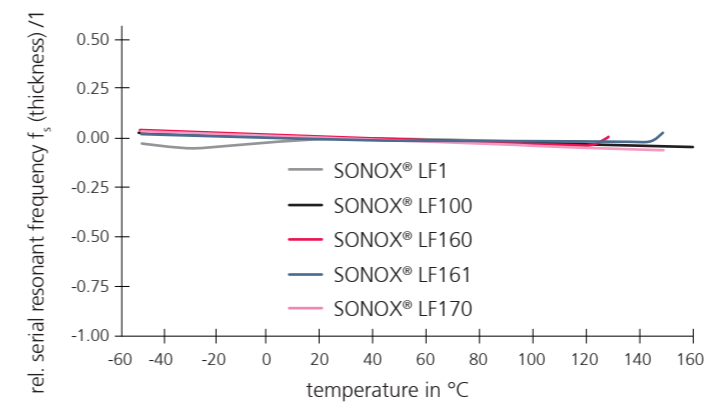
Material		SONOX® LF1	SONOX® LF100	SONOX® LF160	SONOX® LF161	SONOX® LF170	
Dielectric properties							
Relative permittivity ϵ_r	$\epsilon_{33}^T/\epsilon_0$	1150	489	709	504	879	
	$\epsilon_{33}^S/\epsilon_0$	830	360	444	403	612	
	$\epsilon_{11}^T/\epsilon_0$	1330	393	931	781	542	
	$\epsilon_{11}^S/\epsilon_0$	1140	381	749	737	498	
Dielectric dissip. factor $\tan \delta$		10^{-3}	8	30	21	5	25
Depolarisation temperature T_d		$^{\circ}\text{C}$	80	163	110	140	130
Electromechanical properties							
Frequency constant	N_p	kHz x mm	3180	2962	3000	3089	2991
	N_t		2640	2422	2257	2257	2282
	N_1		2300	2367	2269	2317	2255
	N_3		2330	2237	2093	2138	2166
Coupling coefficient	k_p		0.31	0.15	0.30	0.19	0.18
	k_{31}		0.18	0.11	0.19	0.12	0.15
	k_{33}		0.43	0.39	0.50	0.48	0.46
	k_t		0.45	0.44	0.51	0.50	0.48
	k_{15}		0.38	0.17	0.44	0.24	0.28
Charge constant	d_{33}	10^{-12} C/N	135	83	172	129	161
	d_{31}		-52	-20	-45	-18	-37
	d_{15}		210	43	183	91	86
Voltage constant g_{33}		10^{-3} Vm/N	14	19.2	27.4	25.8	20.7
Mechanical properties							
Elastic compliance	S_{11}^E	10^{-12} m ² /N	8.2	7.7	8.4	8.2	8.5
	S_{33}^E		8.5	8.9	10.4	10.1	9.6
Elastic stiffness	C_{33}^D	10^{10} m ² /N	14.6	16.3	15.2	14.7	15.0
	C_{55}^D		36.5	5.7	6.0	5.0	5.6
Density ρ		10^3 kg/m ³	5.7	5.8	5.8	5.7	5.8
Mechan. quality factor Q_m			310	240	140	738	121
Mechan. quality factor $Q_m(k_t)$			283	68	32	76	38
Stability							
Aging rate	Capacitance		-0.5	-0.5	9.5	6.9	11.3
	Frequency	%/Decade	0.1	0.1	2.1	-0.1	-0.5
	Coupling coefficient		0.1	-0.3	-0.9	-1.1	3.1

The materials data shown were evaluated on specific sample components and shall only be used to give an indication for design purposes. These values were determined based on national and international standards, if those standards were not available, then the values were determined on the basis of CeramTec internal standards. The displayed values are material properties and do not guarantee any properties of piezoceramic parts / products. CeramTec and its affiliates do not assume any responsibility for the correctness of such information nor for any damages subject to its use. Please note that material specifications and information detailed in this media are subject to changes.

Relative temperature dependence of coupling coefficient k_t



Relative temperature dependence of serial resonant frequency f_s (thickness)



Relative temperature dependence of permittivity

