

PiezoPower™

High Dielectric Piezoelectric Materials (Typical Properties)

Property	Symbol	Unit	Material Type		
			3252HD	3257HD	3265HD
Dielectric Constant @ 1 kHz	K^T_3		5000	5700	6500
Dielectric Loss @ 1 kHz (Nickel Electrodes) (Gold Electrodes)		%	4.5	4.5	4.5
			2.5	2.5	2.5
Dielectric Constant @ 2 f_n	K^S_3		2000	2200	2500
Density	ρ	g/cc	8.20	8.20	8.20
Curie Point	T_c	°C	>160	155	>135
Mechanical Quality Factor	Q_m		125	120	125
Coupling Coefficients	k_{31}		0.42	.415	0.40
	k_t		0.50	0.50	0.49
Piezoelectric Charge Coefficient	d_{31}	coulombs/N x 10 ⁻¹² or meters/volt x 10 ⁻¹²	345	364	367
	d_{33}			750	
Piezoelectric Voltage Coefficient	g_{31}	Vm/N x 10 ⁻³ or m ² /coulomb	7.8	7.2	6.4
	g_{33}			15	
Frequency Constants					
Thickness (Resonant) (Antiresonant)	N_{tr}	kHz cm	208	208	208
	N_{ta}	kHz cm	235	235	234
Length Extensional (Resonant) (Antiresonant)	N_{31r}	kHz cm	144.5	144	144
	N_{31a}	kHz cm	156	155	154
Elastic Constants					
Short Circuit	S^E_{11}	x 10 ⁻¹² m ² /N	14.6	14.7	14.5
Open Circuit	S^D_{11}	x 10 ⁻¹² m ² /N	11.9	12.2	12.2
Short Circuit	Y^E_{11}	x 10 ¹⁰ N/m ²	6.9	6.8	6.9
Open Circuit	Y^D_{11}	x 10 ¹⁰ N/m ²	8.4	8.2	8.2

Formulas	
Disc Capacitance	$(d^2 \cdot K^T_3) / (5.67 \cdot t)$
Plate Capacitance	$(l \cdot w \cdot K^T_3) / (4.45 \cdot t)$
Disc K^T_3	$(5.662 \cdot \text{Cap} \cdot t) / d^2$
Plate K^T_3	$(4.447 \cdot \text{Cap} \cdot t) / (l \cdot w)$
f_r (radial)	$N_r / (2.54 \cdot d)$
f_r (length)	$N_{31r} / (2.54 \cdot l)$
f_r (width)	$N_{31r} / (2.54 \cdot w)$
f_t (thickness)	$N_t / (2.54 \cdot t)$

Formula length, width, and diameter are for electroded area only.

Definitions					
$\tan \delta_e$	Dielectric Loss Factor	C	Capacitance (nF)	N_r	Radial Frequency Constant
ρ	Mass Density of Ceramic	l	Length (in.)	N_t	Thickness Mode Frequency Constant
T_c	Curie Point	w	Width (in.)	P_r	Remanent Polarization
d_{33}	Direct Charge Coefficient	d	Diameter (in.)	Q_m	Mechanical Q (Quality Factor)
d_{31}	Transverse Charge Coefficient	t	Thickness (10 ⁻³ in.)	Y^E_{33}	Direct Young's Modulus
E_c	Coercive Field	k_{33}	Direct Electromechanical Coupling Coefficient	Y^E_{11}	Elastic Modulus
g_{33}	Direct Voltage Coefficient	k_{31}	Transverse Electromechanical Coupling Coefficient	f_r	Resonant Frequency
g_{31}	Transverse Voltage Coefficient	K^T_3	Free Dielectric Constant Measured Along Poling Axis	f_a	Anti-Resonant Frequency
k_p	Planar Electromechanical Coupling Coefficient				