

## **PROWAVE Catalogue - Aldinet**

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SSOP20

**Features:**

- Operating Voltage: 6 – 12Vdc single source
- Operating Frequency: broadband output ranging up to 200KHz
- Variable R/C Oscillator: compensates for transducer resonate frequency drift due to temperature.
- High Gain Amplifier: varies with time over 32 steps
- Integrated Band Pass Filter: reduces external component count
- Bi-direction I/O Pin: simplifies the control function for transmitting a pulse and receiving an echo
- An adjustable System Clock: enables the control of, the number of pulses transmitted, the slope of the variable gain amplifier, and the pulse repetition rate.
- The PW0268 IC is suitable for use in car reversing aids, electronic tape measures and other sonar ranging applications.

**Description:**

The PW-0268 ultrasonic sonar ranging IC is ideally suited for echo ranging systems. This chip has many design features to enhance its performance and ease of use in this application.

The externally tunable RC Oscillator automatically tracks and compensates for the shift of the resonate frequency of the transducer due to temperature changes.

The Fix Gain Preamplifier can be tailored to compensate for varying transducer sensitivities. The 32-step Time Controlled Variable Gain Amplifier slope can be modified by adjusting the frequency of the system clock.

An onboard Comparator converts the analog signal of the returning echo to a TTL level digital signal for use with an external microprocessor.

The integrated Band Pass Filters can be adjusted for custom applications by changing a few external components. The frequency of the System Clock can be adjusted to control other operating parameters of the chip including the transmit pulse width and sample rate.

The I<sub>O</sub> pin, (pin 1) is a bi-direction pin and is designed as an open collector connection with an internal pull high resistor. When the I<sub>O</sub> pin is being pulled low by an external transistor, the RC oscillator generates a tone burst signal at DRIVER<sub>0</sub> (pin 11), the output driver stage for the transducer. After the transmit pulse, the I<sub>O</sub> pin, (pin 1) will again go low if a valid echo signal is detected.

The reflected echo signal is presented to the first stage pre-amplifier through ECHO (pin 10). The gain of pre-amplifier can be adjusted to accommodate transducers with varying sensitivities by changing an external resistor between ECHO (pin 10) and GR<sub>I</sub> (pin 9).

The 32 steps time controlled variable gain amplifier input TCG<sub>I</sub> (pin7) and output TCG<sub>O</sub> (pin 6) is synchronized to start incrementing at the end of control pulse signal I-O, (pin 1) and is reset at the beginning of the next control pulse.

Only a few passive components are needed for the active band pass filter. There are two stages, a low pass, LP<sub>I</sub> (pin 5) and LP<sub>O</sub> (pin 4) and upper band pass, HP<sub>I</sub> (pin 3) to HP<sub>O</sub> (pin 2). The center frequency and bandwidth of the filter are chosen based on the type of ultrasonic transducer being used and the specific application. The amplified echo signal after being filtered is routed to a comparator, which shapes and converts the analog echo signal into digital signal outputted at I<sub>O</sub> (pin 1) for further  $\mu$ P handling.

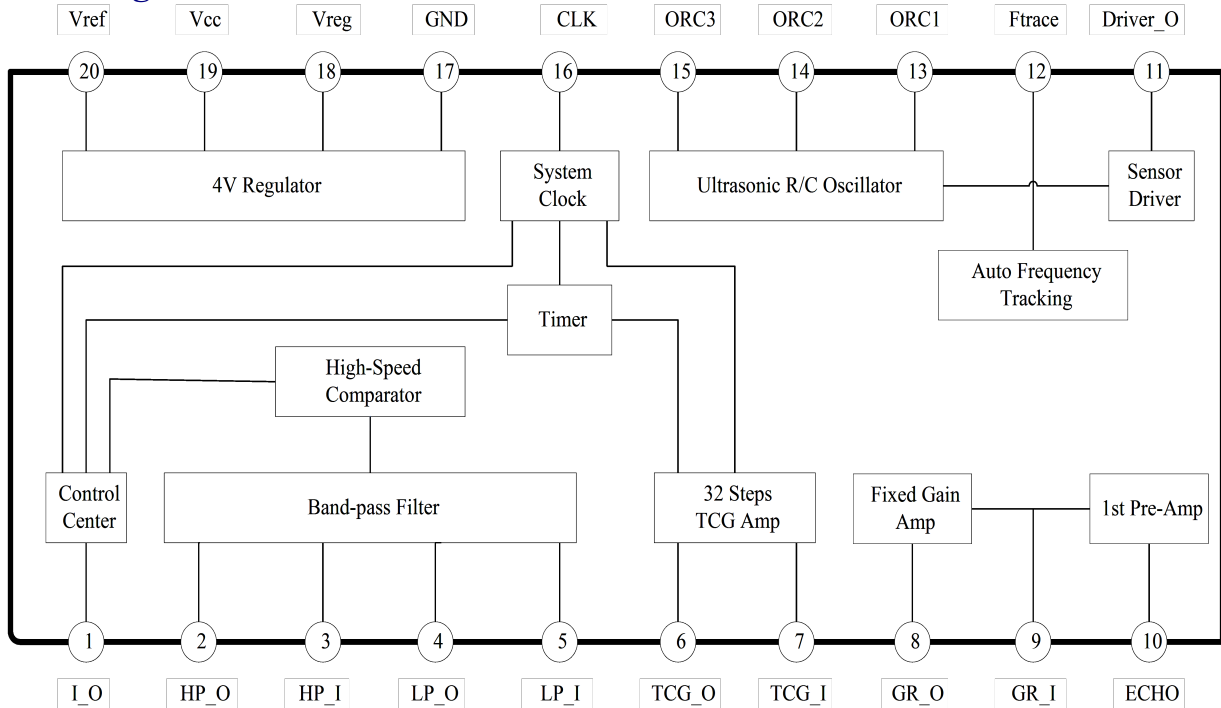
The unique temperature compensating Ultrasonic R/C Oscillator circuitry tracks the resonant frequency drift of the transducer that is caused by environment temperature changes. Simply adding dual diodes and one resistor between DRIVER<sub>O</sub> (pin 11) and Ftrace (pin 12) is all that is needed to complete this function.



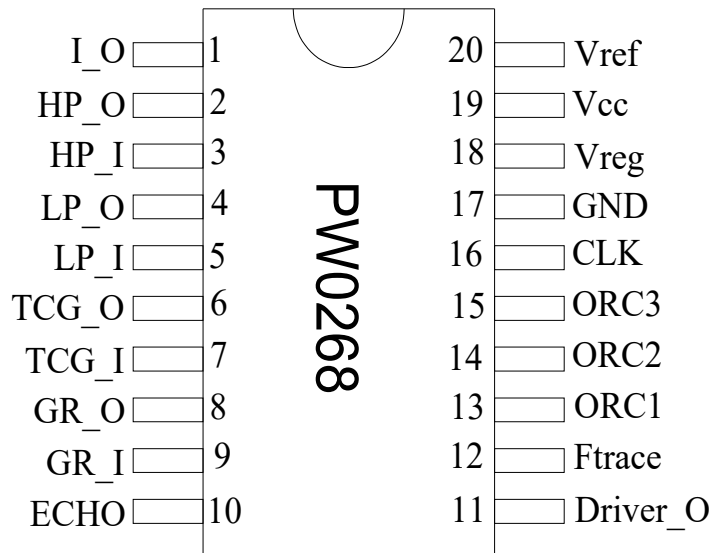
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**Block Diagram:**



**Pin Assignment:**



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## Ultrasonic Sonar Ranging IC

PW0268

## Specifications:

Unless otherwise specified, all data measured under  $V_{cc} = 10V$ ,  $F = 40KHz$ , Temperature =  $25^{\circ}C$ 

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	Vcc	Vreg = 5V (1)	7		12	V
Supply Current	Icc	Vcc = 7 ~ 12V	10	16.5	22	mA
Regulated Voltage	Vreg	Vcc = 7 ~ 12V	4.6	5	5.4	V
Reference Voltage	Vref	Vcc = 7 ~ 12V, RL > 2KΩ	2.2	2.4	2.6	V
Op-Amp Slew Rate	SR	Vin = 3Vpp	5	-	-	V/μs
Comparator Trigger Level	Tcomp	Over Vref	300	350	400	mV
System Clock Frequency	CLKf	R=39KΩ, C=22pF	610	660	710	KHz
System Clock Frequency Range	CLKr		0.001	-	1500	KHz
Ultrasonic Oscillation Frequency	Fosc f	R=3.9KΩ, C=2200pF	38	40	42	KHz
Ultrasonic Oscillation Frequency Range	Fosc r		0.001	-	500	KHz
2 <sup>nd</sup> Amp Gain	GR		29	30	31	dB
Time Controlled Gain Amplifier	TCGain	Min(1x, 0dB)	-1	0	1	dB
		Max(58x, 35.2dB)	34	35	36	
Bandwidth of 2nd Amp	GRbw	Gain = 30dB		250	350	KHz
Driving Current	Idrv	Voh=Vreg-0.7V	-	20	40	mA
	Isink	Vol=0.7v-GND	-40	-20	-	
MCU Input Level	MCUVIH		2.5	-	-	V
	MCUVIL		-	-	0.8	
MCU Output Level	MCUVOH		-	-	1	Vcc
	MCUVOL		0.2	-	-	
MCU Low Level Input Current	MCUIOL		-	-10	-20	mA
I_O Internal Pull Up Resistance	Rup		3.5	5	6.5	KΩ

(1)When VCC = 6V, Vreg only guarantee greater than 4V, other functions are not affected.

## Absolute Maximum Ratings

Description	Symbol	Condition	Min.	Max.	Unit
Supply Voltage	Vcc		0	15	V
Operation Temperature	Topr		-40	85	°C
Storage Temperature	Tstg		-65	150	°C
Max. Pin Input Voltage	Vimax	I_O, Vcc	-0.3	Vcc+0.3	V
		Others	-0.3	Vreg+0.3	
Max. Input Current	Iimax	*	-10	10	mA

\*To prevent latch up, the instantaneous input current should be no large than 100mA for each pins.



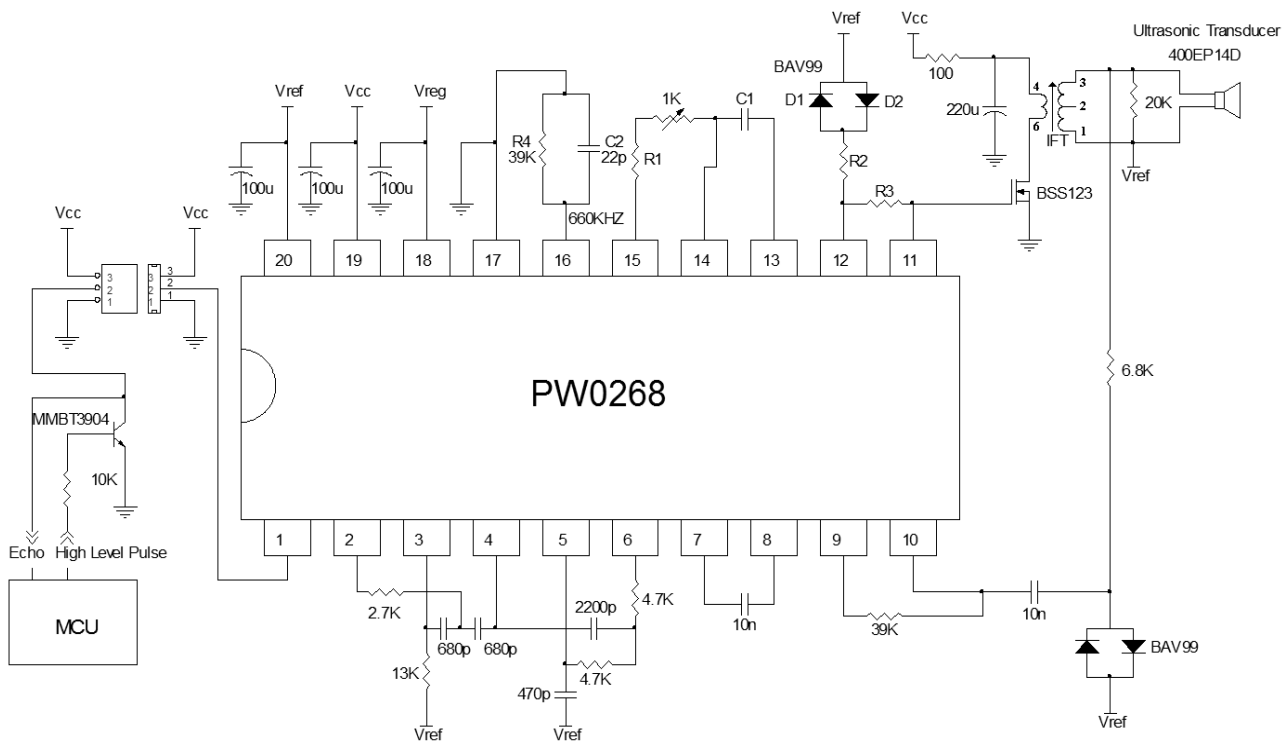
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**Pins Description:**

Pin	Name	Description	Pin	Name	Description
1	I_O	Input/Output	11	Driver_O	Transducer driving output
2	HP_O	High pass filter output	12	Ftrace	Frequency tracing input
3	HP_I	High pass filter input	13	ORC1	RC oscillator: terminal 1
4	LP_O	Low pass filter output	14	ORC2	RC oscillator: terminal 2
5	LP_I	Low pass filter input	15	ORC3	RC oscillator: terminal 3
6	TCG_O	Time controlled gain output	16	CLK	System clock
7	TCG_I	Time controlled gain input	17	GND	Ground
8	GR_O	External adjustable gain output	18	Vreg	Regulated voltage for internal analogue devices
9	GR_I	External adjustable gain input	19	Vcc	Power supply
10	ECHO	Receiving echo input	20	Vref	Reference voltage output

**Application Circuit:** for car reversing aids (values should be changed for other applications)



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### Application Note

The circuit shown on page 4 is a typical circuit for car reversing aids. The RC Oscillator generates a tone burst when a low level pulse is applied to the I\_O pin, (pin 1).

To accommodate tolerance variations of transducers during manufacturing, a 1K-ohm variable resistor (R1) is provided to trim the output operating frequency. The range of adjustment is from 38.0 – 42.0 KHz. and allows for a better match of the drive signal to the resonate frequency of the transducer.

The active burst number (number of pulses transmitted) is controlled by the pulse width of the low level signal applied to the I\_O pin, (pin 1).

The tone burst output, Driver\_O (pin 11), drives the transducer through a MOSFET transistor and impedance matching transformer IFT. The inductance in the secondary winding of the transformer is designed to tune out the reactance of the parallel capacitance of the transducer.

The high output voltage of the tone burst is snubbed by two diodes and the returning echo signal is passed on to the first stage pre-amplifier. The signal is then passed on to the second stage fix gain amplifier and finally to the third stage 32-step time controlled variable gain amplifier. The gain of the pre-amplifier should be properly set to meet the sensitivity needs of the transducer and application requirements.

The center frequency of band-pass filter should be chosen to exactly match the frequency of the RC Oscillator and considerations for the width of pass-band filter should be made based on actual application requirements.

If the amplified echo signal from the output of the band pass filter exceeds  $0.35V + V_{ref}$ , the comparator will output a low pulse to the I\_O pin, (pin 1). The width of the low level pulse is proportional to the echo signal strength.

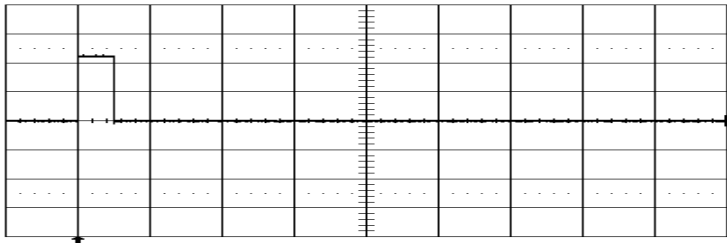


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The above description is summarized in the signal timing charts illustrated below.

MCU output: H: 1ms/Div., V: 2.0V/Div.

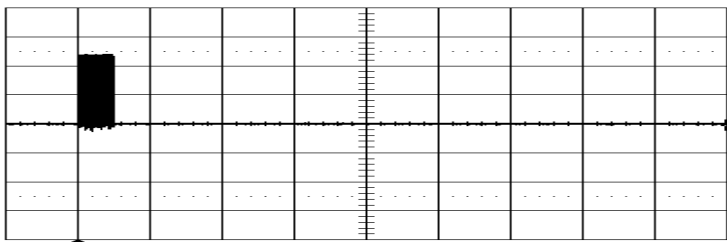


The RC oscillator will be enabled in the duration of input pulse. The maximum pulse width is  $400/F$  and any time longer than this upper limit will be ignored.

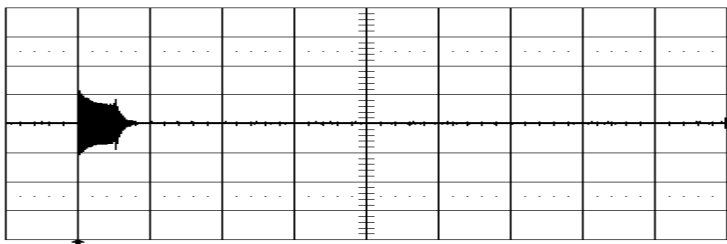
The next input pulse will be ignored if the pulse repetition rate is shorter than  $10000/F + \text{pulse width}$ .

F : Frequency of system clock

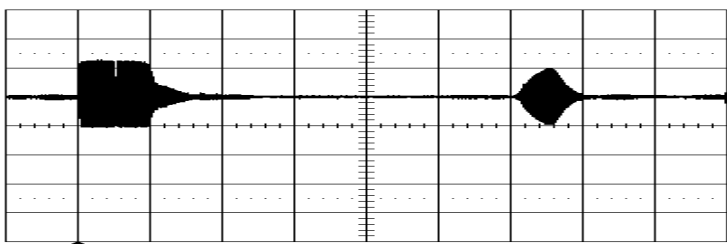
Driver\_O (Pin 11): H: 1ms/Div., V: 2.0V/Div.



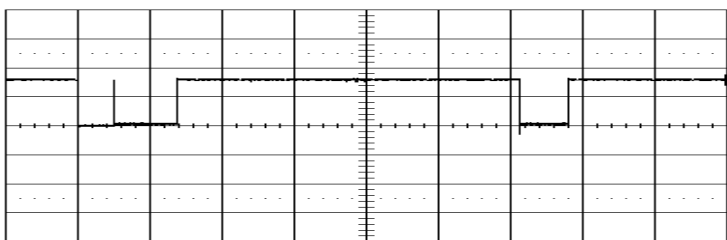
Transducer Oscillation: H: 1ms/Div., V: 50V/Div.



HP\_O (Pin 2): H: 1ms/Div., V: 2.0V/Div.



Output at Pin 1 I\_O: H: 1ms/Div., V: 5.0V/Div.



The resonate frequency of ultrasonic piezo transducers varies in an inversely proportional relationship to temperature. The lower the temperature, the higher the resonate frequency, the higher the temperature the lower the resonate frequency.

This property of piezo transducers may cause a mismatch between transducer and drive signal with changes in ambient temperature and reduces efficiency of the system when the frequency of the drive circuit remains constant and does not track the resonate frequency shift of the transducer.

Therefore it is desirable to have the output frequency of the drive source track the resonate frequency of the transducer with changes in ambient temperature. The Auto Frequency Tracking circuitry between Ftrace, (pin 12), and Drive\_O, (pin 11) is used to accomplish this task.

The voltage change at Ftrace (pin 11) varies in proportion to the forward bias voltage change across diodes D1, D2. This change is caused by the negative temperature coefficient of the diodes and the ratio of the resistor circuit R2/R3.

A lower temperature increases the voltage drop across the diodes. This intern accelerates the charge rate of an internal integrator circuit controlling the R/C Oscillator, ORC3, (pin15). The net result is the adjustment to the R/C Oscillator increases the resonate frequency of the output, Drive\_O, (pin11).

Conversely, a higher temperature decreases the voltage drop across the diodes. This slows the charge rate of the internal integrator circuit controlling the R/C Oscillator. The net result of this adjustment is to decrease the resonate frequency of the output Drive\_O, (pin 11).

Choose values for the components R1, R2, R3 and C1 that will best track the characteristic resonate frequency shift curves due to temperature for a specific transducer.

**Recommended values for the following transducers are listed below.**

Used Transducer	R1(Ohm)	R2(Ohm)	R3(Ohm)	C1(pF)
400EP14D	3300	820	510	2200
125SR250	3300	150	1500	390
200GE180	2200	1500	510	390

For a fixed output of 40KHz at Drive\_O (pin 11) simply remove D1, D2 and R2 and set R1 = 4,500 Ohm, C1 = 2,200 pF, and R3 = 510 Ohm.

The system clock CLK (pin 16) controls the maximum input pulse width, the slope of time controlled gain amplifier and pulse repetition rate.

For example, as illustrated in the block diagram, if the system clock is set to 660KHz (C2: 22pF, R4: 39K Ohm), then:

- (1) The maximum input pulse width is  $400/F = 400/660K = 0.6$  ms and any duration longer than 0.6ms will be ignored.
- (2) The step duration of the 32 step time controlled gain amplifier is equal to  $220/F = 0.333$  ms, starting from the end of the pulse on the I\_O pin, (pin 1).
- (3) The minimum pulse repetition rate is  $10000/F + \text{pulse width} = 10000/F + 0.5$  ms (20 bursts of 40KHz) =  $10000/660K + 0.5 = 15.65$  ms.

For long distance measurements of 18 meters (one way distance), the system clock should be set as follows:

Min. Pulse Repetition Rate =  $10000/F + 0.75 = 167$  ms (30 bursts of 40KHz)

Frequency of System Clock F = 60 KHz

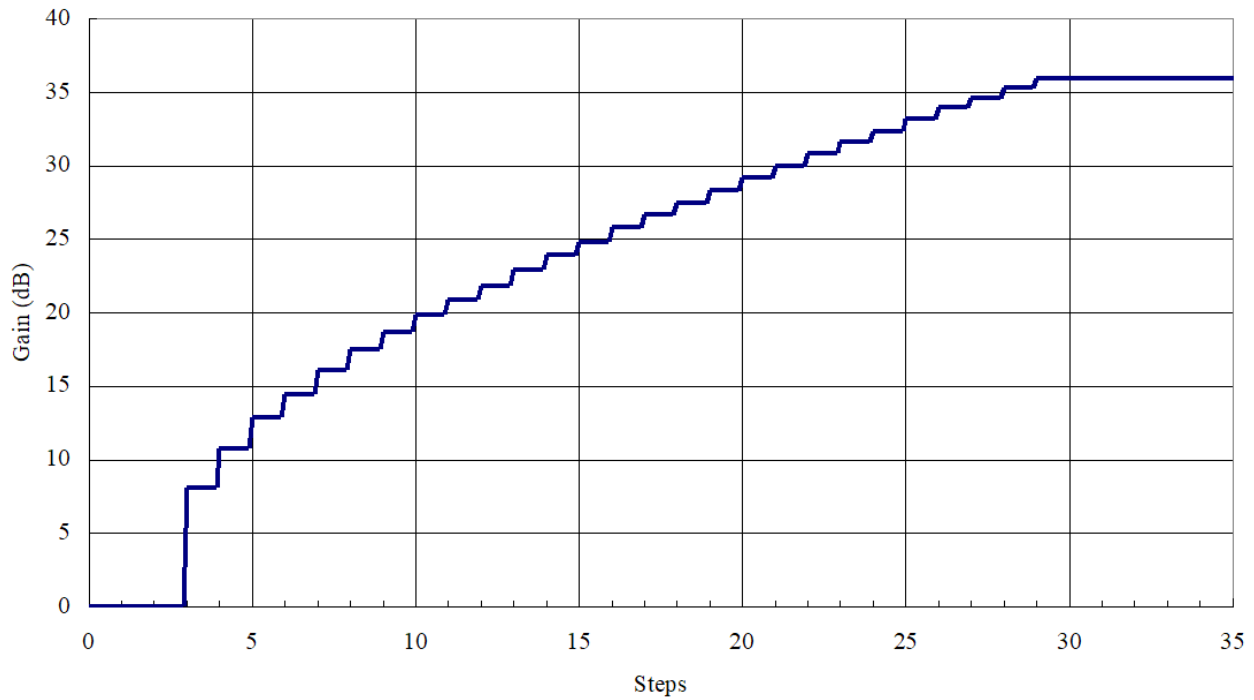
**For additional information about an 18-meter tape measure circuit, please consult with the factory.**



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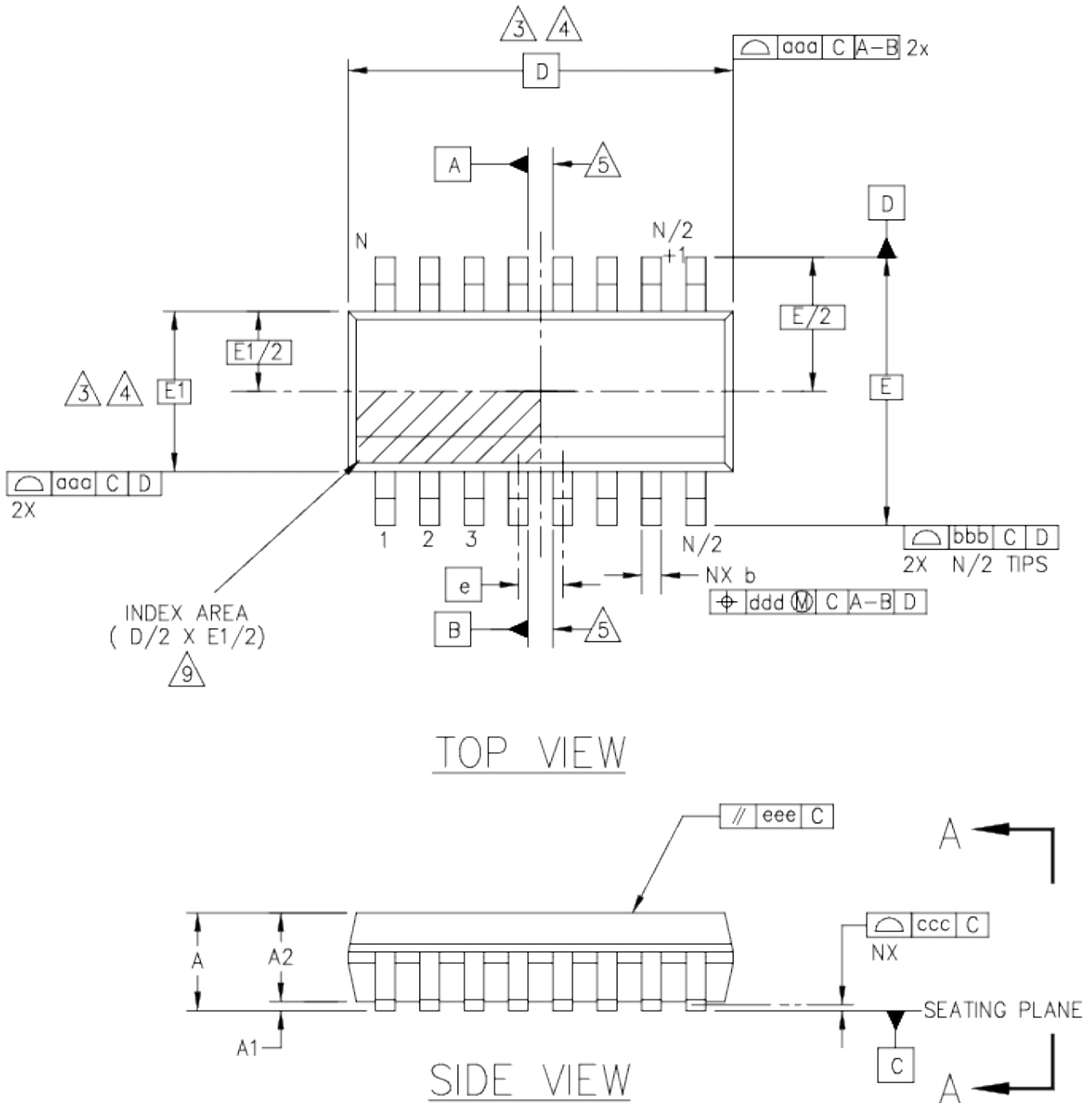


**Time Controlled Gain Amplifier:**

The time controlled gain amplifier is stepping up once the input pulse falling. The time duration can be calculated as:

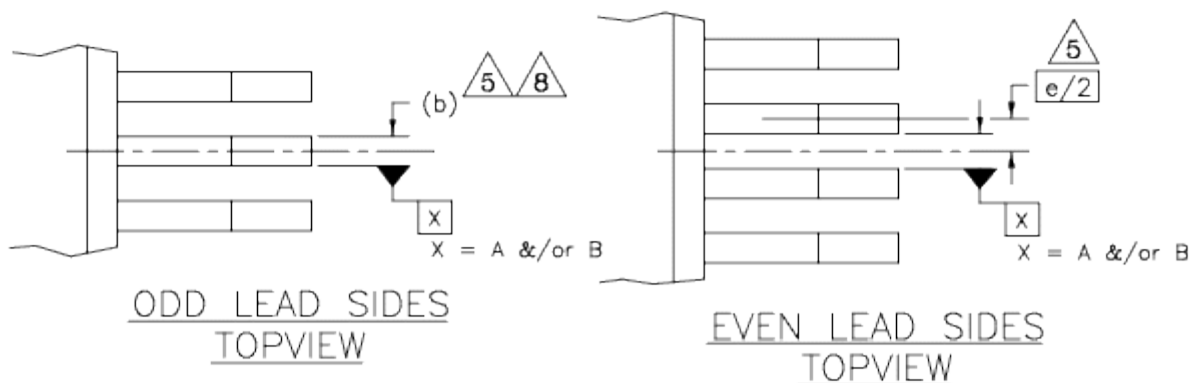
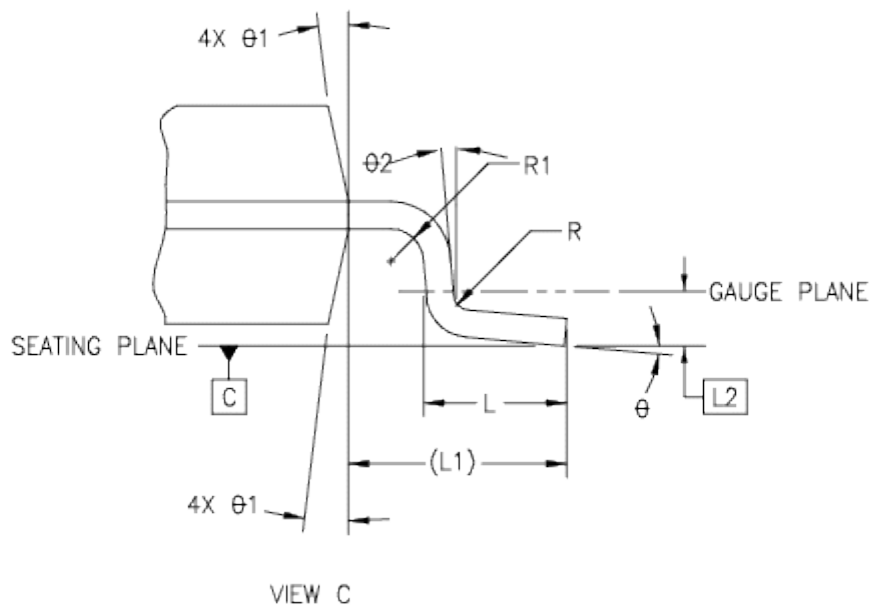
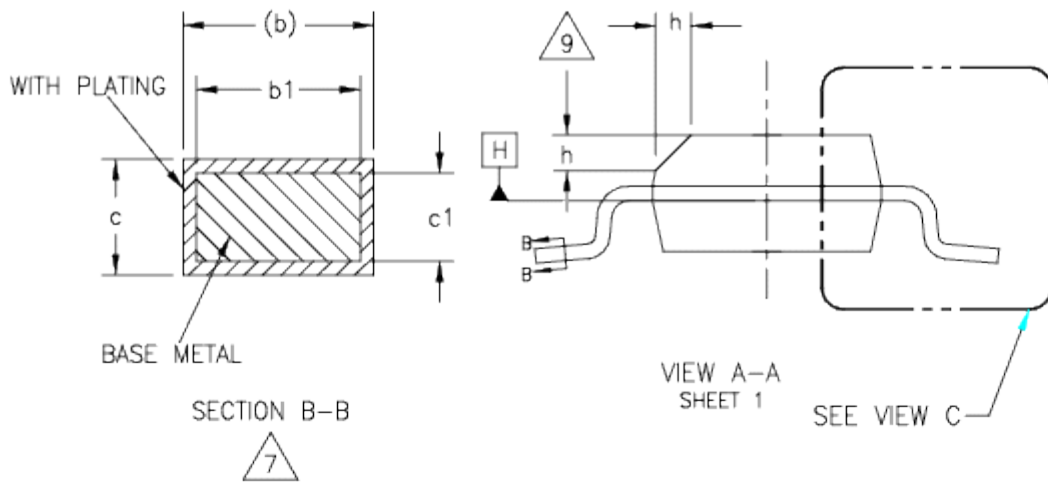
$$T = 220/F \quad \mathbf{F: \text{Frequency of System Clock}}$$

**Package and Dimensions:**  
 20 Pins, SSOP (150mil)



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Symbol	Min.	Nom.	Max.
A	0.053	-	0.069
A1	0.004	-	0.010
A2	0.049	-	0.065
b	0.008	-	0.012
b1	0.008	0.010	0.011
c	0.006	-	0.010
c1	0.006	0.008	0.009
D	0.341 BSC		
E	0.236 BSC		
E1	0.154 BSC		
e	0.025 BAS		
L	0.016	-	0.050
L1	0.041 REF		
L2	0.010 BAS		
R	0.003	-	-
R1	0.003	-	-
$\theta$	0°	-	8°
$\theta 1$	5°	-	15°
$\theta 2$	0°	-	-
aaa	0.004		
bbb	0.008		
ccc	0.004		
ddd	0.007		
eee	0.004		



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**Notes:**

- Dimensioning and tolerancing per ANSI Y14.5M-1982.
- Dimensions in inches (angles in degrees)
- Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.006" per end. Dimension E1 does not include interlead flash or protrusions. Interlead flash or protrusions shall not exceed "0.006" per side. D1 and E1 dimensions are determined at datum H.
- The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic.
- Datum A and B to be determined at datum H.
- N is the maximum number of terminal position. (N=20)
- The dimensions apply to the flat section of the lead between 0.004 to 0.010 inches from the lead tip.
- Dimension b does not include dambar protrusion. Allowable dambar protrusion shall be 0.004" total in excess of b dimension at maximum material condition. The dambar can not be located on the lower radius of the foot.
- Refer to JEDEC MO-137 variation AD.

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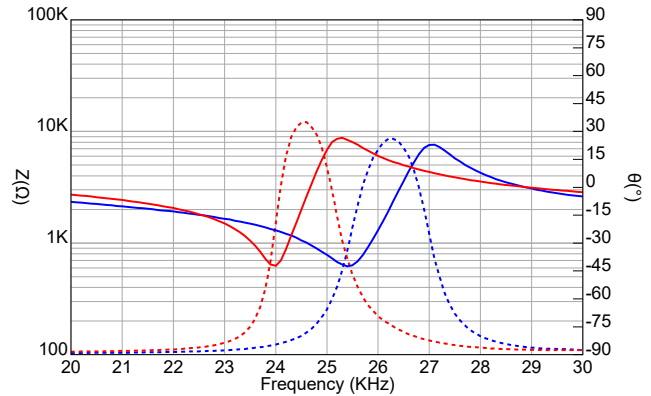
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### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level.

250SR160 Impedance ————  
 250SR160 Phase - - - - -  
 250ST160 Impedance ————  
 250ST160 Phase - - - - -



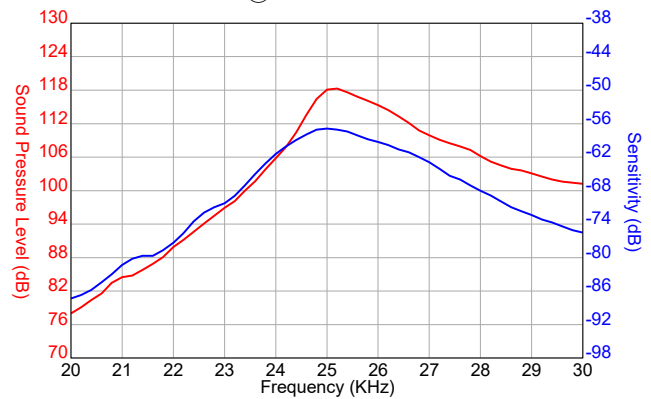
### Specification

250ST160	Transmitter
250SR160	Receiver
Center Frequency	25.0±1.0KHz
Bandwidth (-6dB)	2.0KHz
Transmitting Sound Pressure Level at 25.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	112dB min.
Receiving Sensitivity at 25.0KHz 0dB = 1 volt/μbar	-62dB min.
Capacitance at 1KHz ±20%	250ST 3000 pF 250SR 2600 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle (-6dB)	85° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm

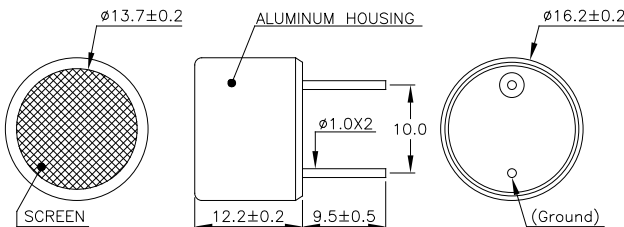


Model available:

1	250ST/R160	Aluminum Housing
2	250ST/R16B	Black Aluminum Housing
3	250ST/R16P	Plastic Housing

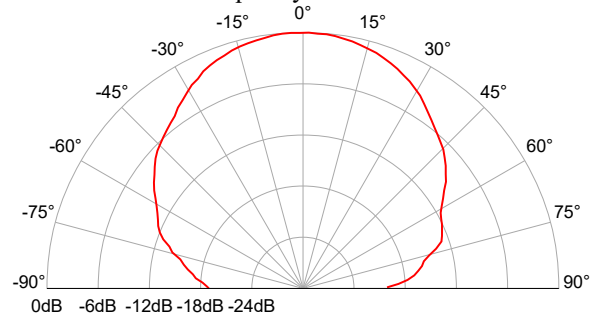
### Dimensions

dimensions are in mm



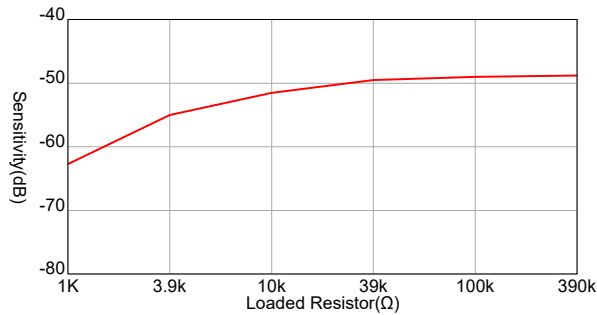
### Beam Angle

Tested at 25.0KHz Frequency

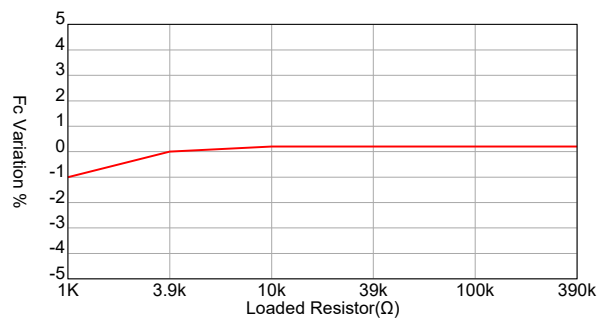


### 250SR160 Receiver

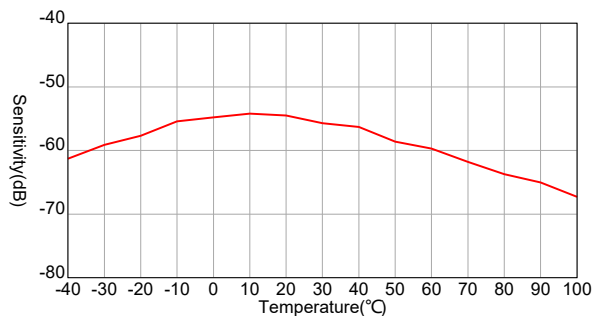
#### Sensitivity Variation vs. Loaded Resistor



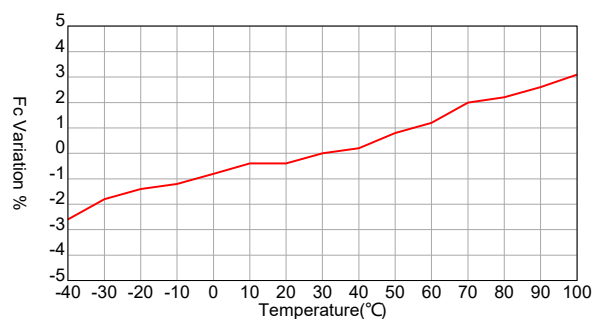
#### Center Frequency Shift vs. Loaded Resistor



#### Sensitivity Variation vs. Temperature

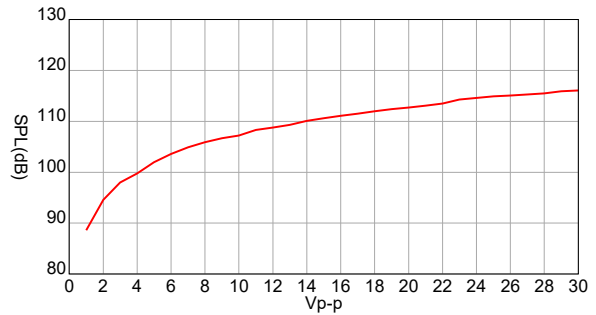


#### Center Frequency Shift vs. Temperature

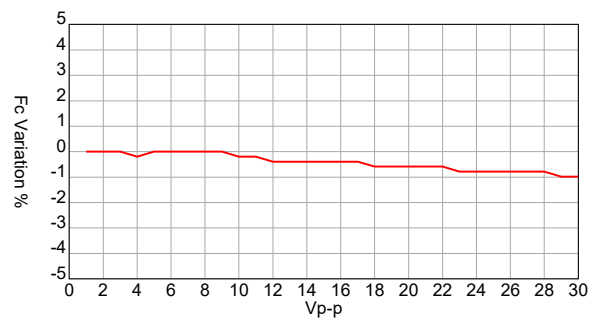


### 250ST160 Transmitter

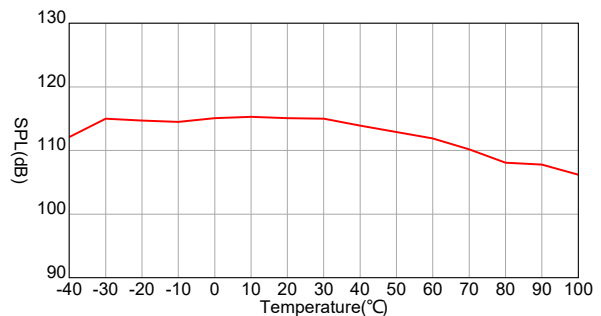
#### SPL Variation vs. Driving Voltage



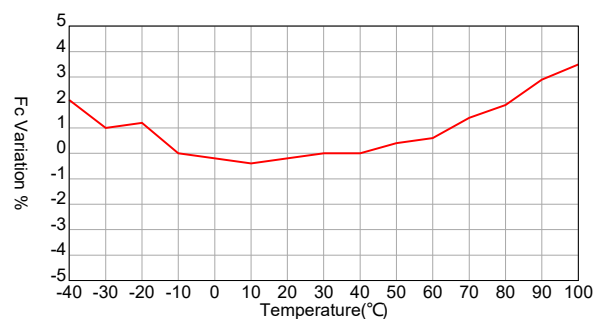
#### Center Frequency Shift vs. Driving Voltage



#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



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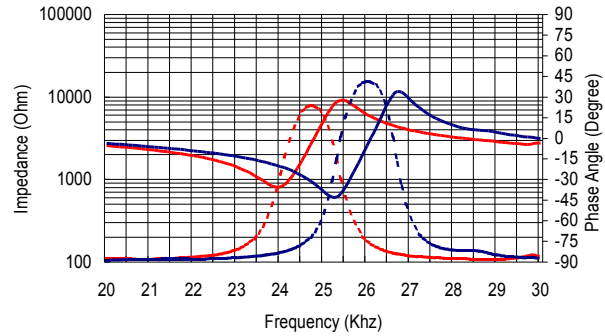
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### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

250SR180 Impedance —————  
 250SR180 Phase - - - - -  
 250ST180 Impedance —————  
 250ST180 Phase - - - - -



### Specification

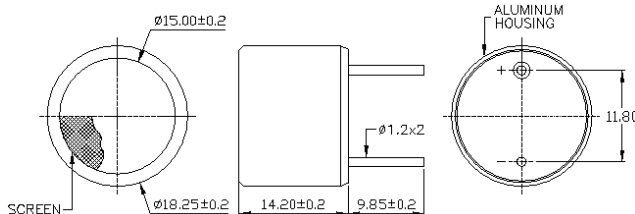
250ST180	Transmitter
250SR180	Receiver
Center Frequency	25.0±1.0KHz
Bandwidth (-6dB)	250ST180 1.5KHz 250SR180 1.8KHz
Transmitting Sound Pressure Level at 25.0KHz; 0dB re 0.0002µbar per 10Vrms at 30cm	112dB min.
Receiving Sensitivity at 25.0KHz 0dB = 1 volt/µbar	-62dB min.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	95° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

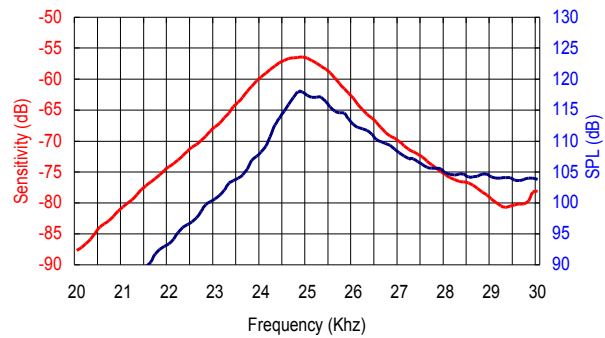
1	250ST/R180	Aluminum Housing
2	250ST/R18B	Black Al. Housing

**Dimensions:** dimensions are in mm



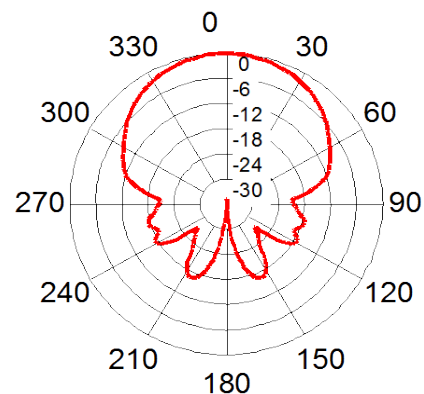
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

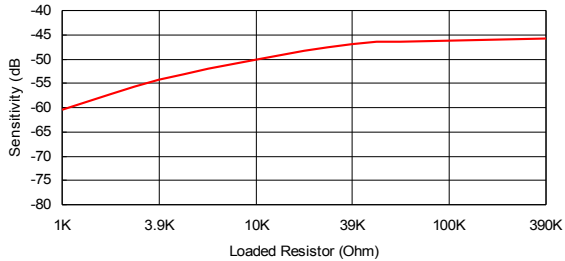
Tested at 25.0KHz frequency





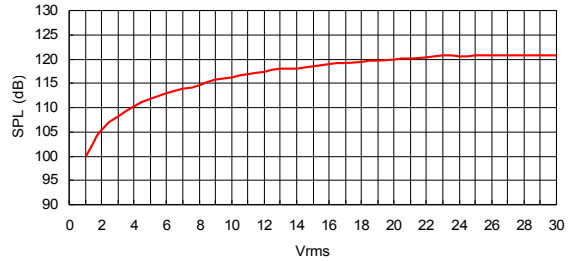
### 250SR180 Receiver

#### Sensitivity Variation vs. Loaded Resistor

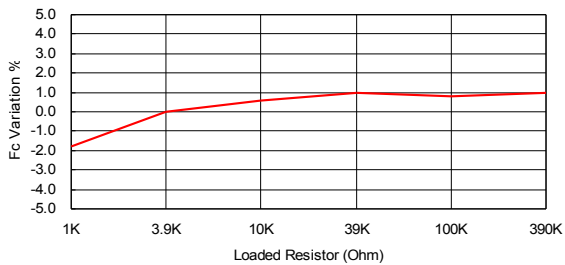


### 250ST180 Transmitter

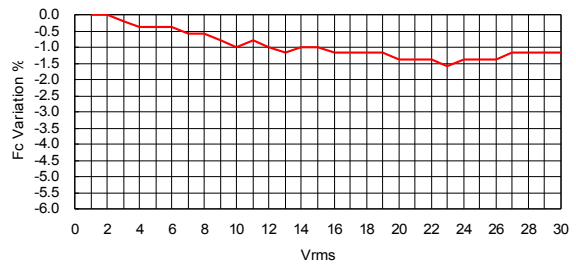
#### SPL Variation vs. Driving Voltage



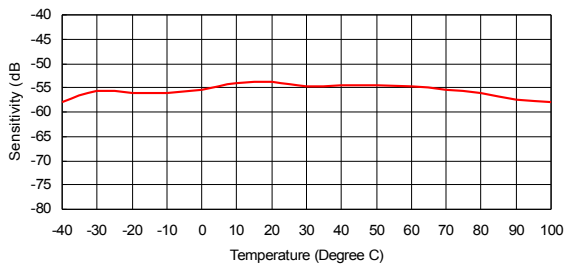
#### Center Frequency Shift vs. Loaded Resistor



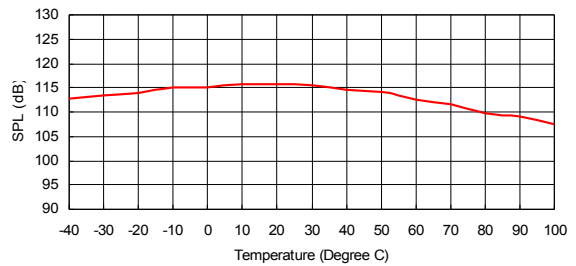
#### Center Frequency Shift vs. Driving Voltage



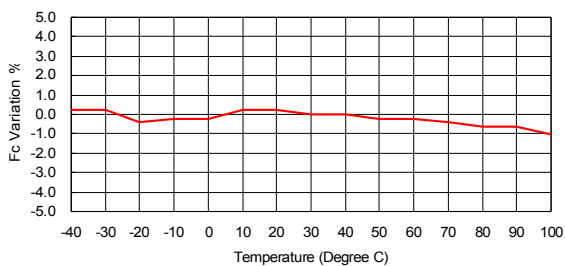
#### Sensitivity Variation vs. Temperature



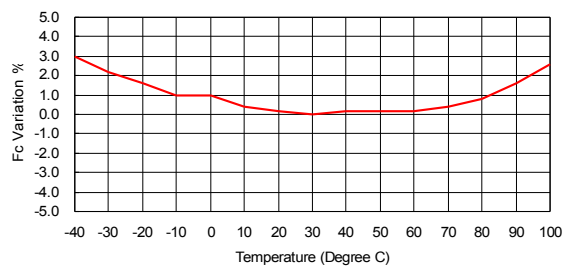
#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



#### Center Frequency Shift vs. Temperature



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## Air Ultrasonic Ceramic Transducers

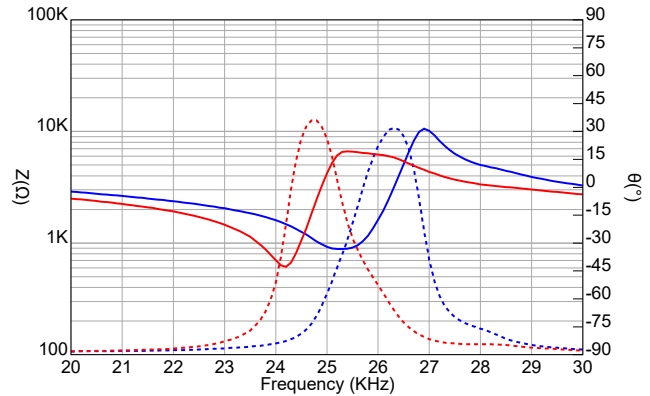
250ST/R240



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

250SR240 Impedance (Red solid line)  
 250SR240 Phase (Red dashed line)  
 250ST240 Impedance (Blue solid line)  
 250ST240 Phase (Blue dashed line)



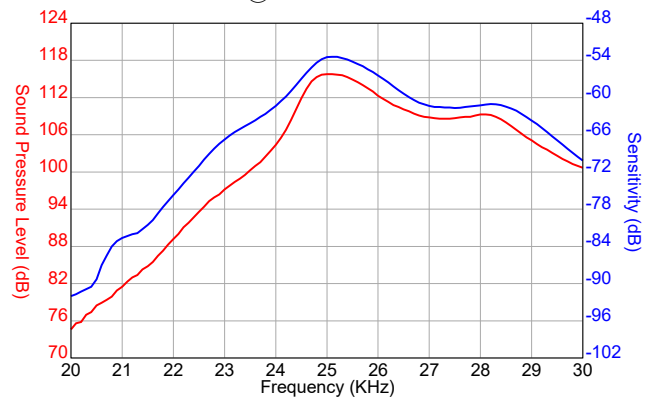
### Specification

250ST240	Transmitter
250SR240	Receiver
Center Frequency	25.0±1.0KHz
Bandwidth (-6dB)	250ST 1.5KHz
	250SR 1.8KHz
Transmitting Sound Pressure Level at 25.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	115dB min.
Receiving Sensitivity at 25.0KHz 0dB = 1 volt/μbar	-60dB min.
Capacitance at 1KHz ±20%	250ST 3000 pF
	250SR 2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle (-6dB)	55° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

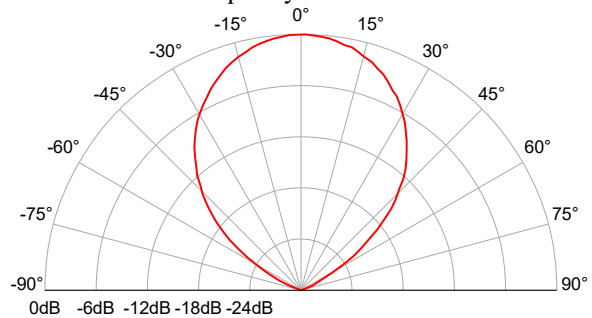
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

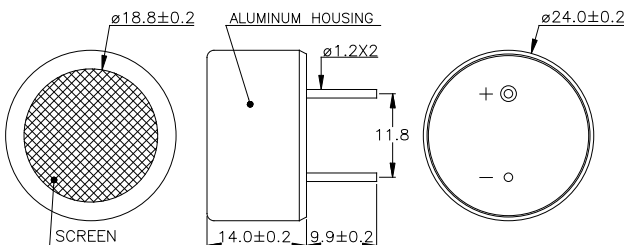
Tested at 25.0KHz frequency



Model available:

1	250ST/R240	Aluminum Housing
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**Dimensions:** dimensions are in mm

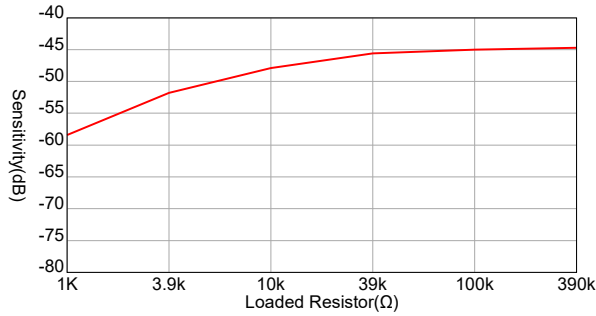


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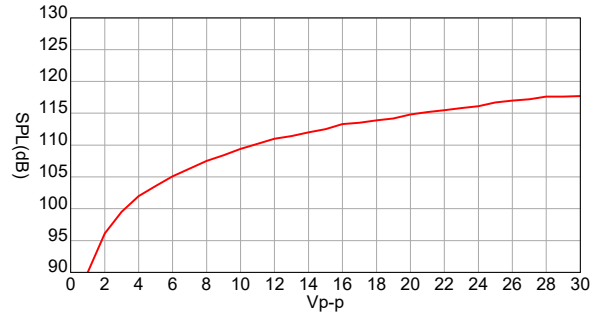
**250SR240 Receiver**

**Sensitivity Variation vs. Loaded Resistor**

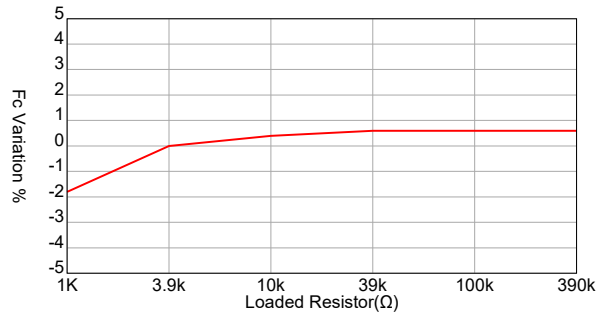


**250ST240 Transmitter**

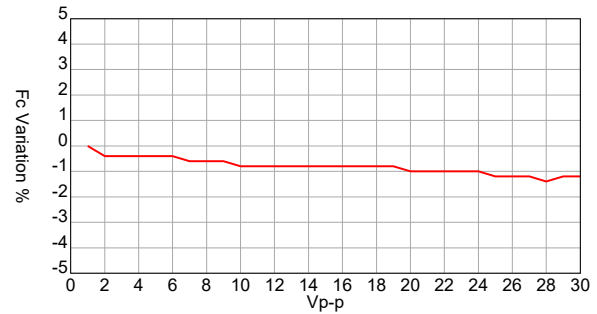
**SPL Variation vs. Driving Voltage**



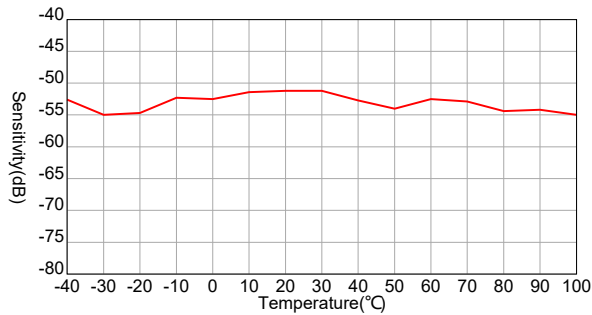
**Center Frequency Shift vs. Loaded Resistor**



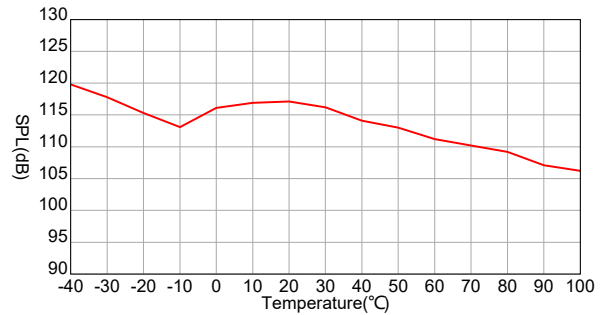
**Center Frequency Shift vs. Driving Voltage**



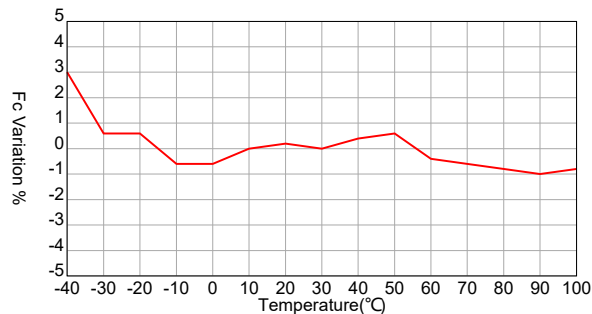
**Sensitivity Variation vs. Temperature**



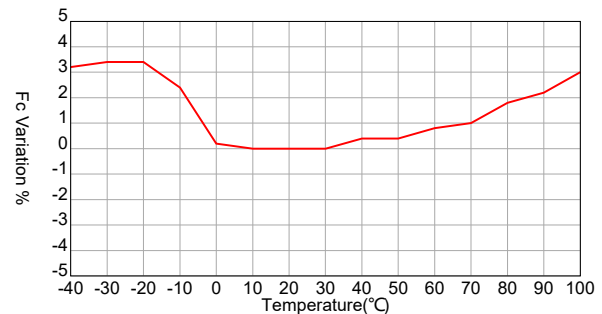
**SPL Variation vs. Temperature**



**Center Frequency Shift vs. Temperature**



**Center Frequency Shift vs. Temperature**



## Air Ultrasonic Ceramic Transducers

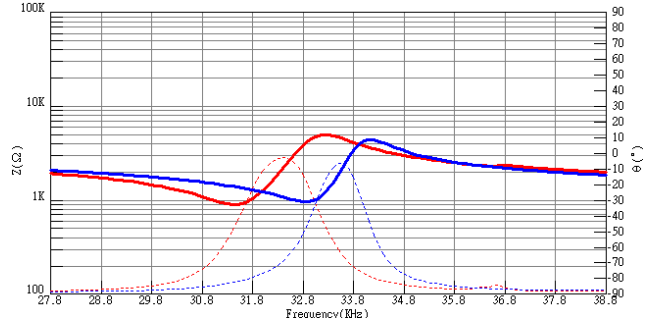
328ST/R160



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

328SR160 Impedance ————  
 328SR160 Phase - - - - -  
 328ST160 Impedance ————  
 328ST160 Phase - - - - -



### Specification

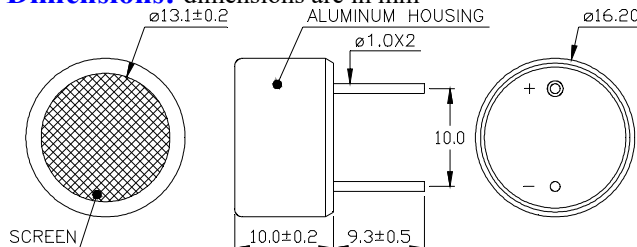
328ST160	Transmitter
328SR160	Receiver
Center Frequency	32.8±1.0KHz
Bandwidth (-6dB)	328ST160 2.0KHz
	328SR160 2.5KHz
Transmitting Sound Pressure Level at 32.8KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	115dB min.
Receiving Sensitivity at 32.8KHz 0dB = 1 volt/μbar	-67dB min.
Capacitance at 1KHz ±20%	2600 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	75° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

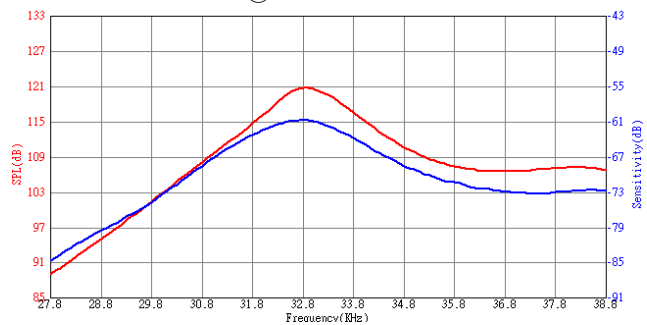
1	328ST/R160	Aluminum Housing
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**Dimensions:** dimensions are in mm



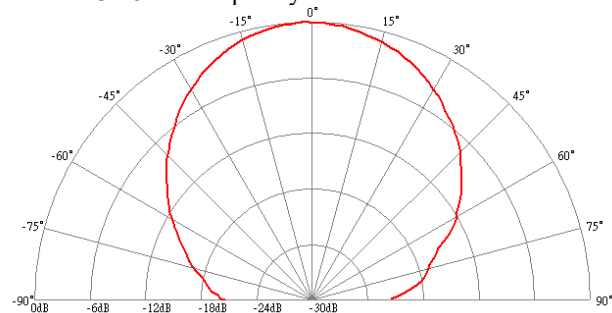
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 32.8KHz frequency

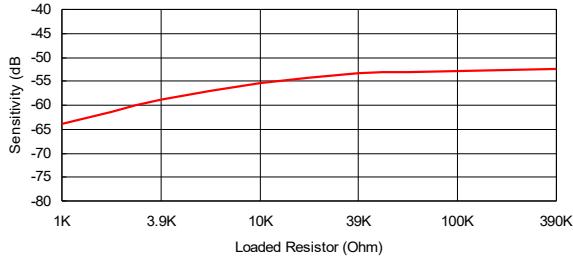


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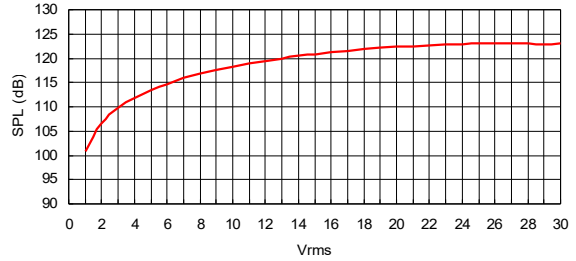
### 328SR160 Receiver

#### Sensitivity Variation vs. Loaded Resistor

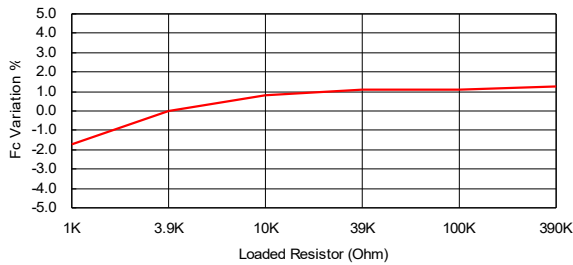


### 328ST160 Transmitter

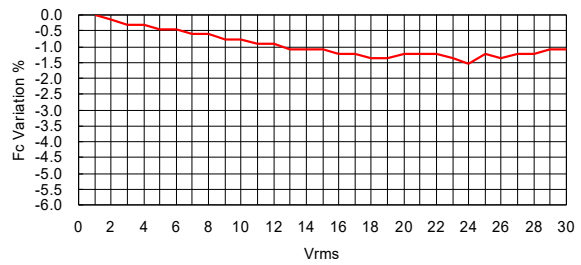
#### SPL Variation vs. Driving Voltage



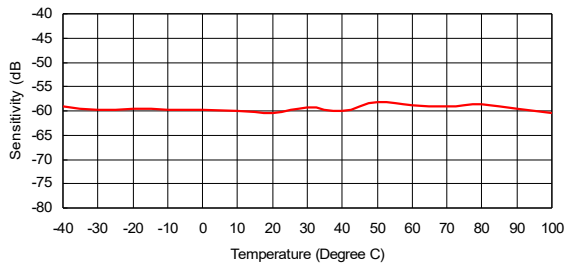
#### Center Frequency Shift vs. Loaded Resistor



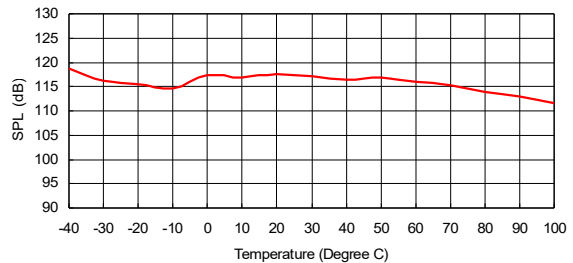
#### Center Frequency Shift vs. Driving Voltage



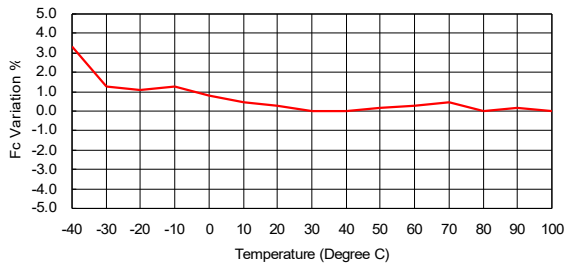
#### Sensitivity Variation vs. Temperature



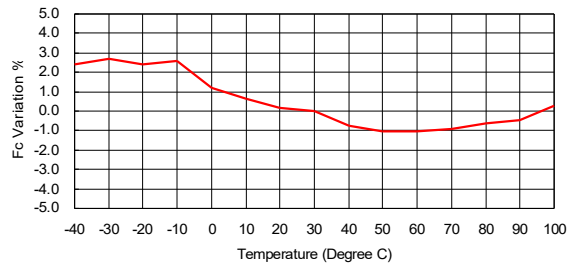
#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



#### Center Frequency Shift vs. Temperature



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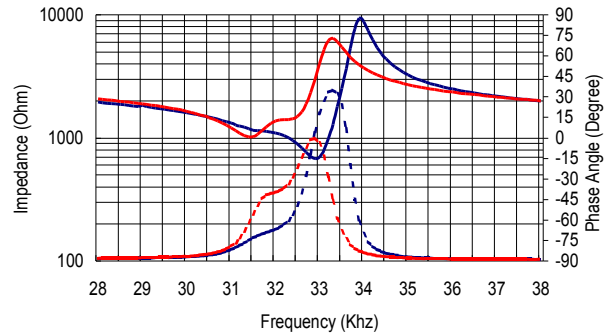
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### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

328SR180 Impedance ————  
 328SR180 Phase - - - - -  
 328ST180 Impedance ————  
 328ST180 Phase - - - - -



### Specification

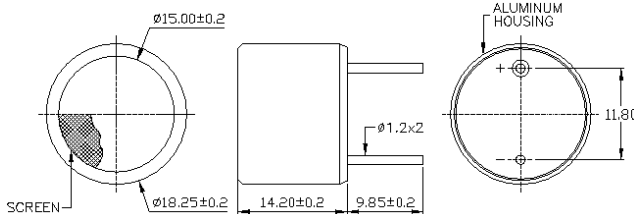
328ST180	Transmitter
328SR180	Receiver
Center Frequency	32.8±1.0KHz
Bandwidth (-6dB)	328ST180 2KHz 328SR180 2KHz
Transmitting Sound Pressure Level at 32.8KHz; 0dB re 0.0002µbar per 10Vrms at 30cm	117dB min.
Receiving Sensitivity at 32.8KHz 0dB = 1 volt/µbar	-64dB min.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	45° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

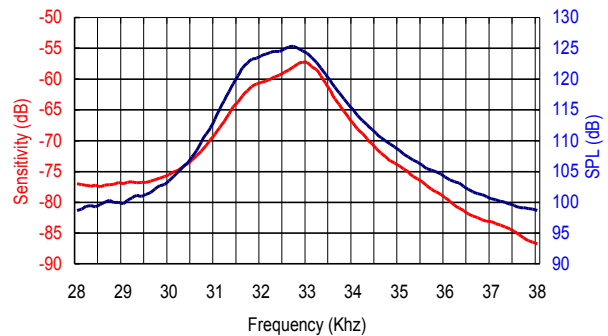
1	328ST/R180	Aluminum Housing
2	328ST/R18B	Black Al. Housing

**Dimensions:** dimensions are in mm



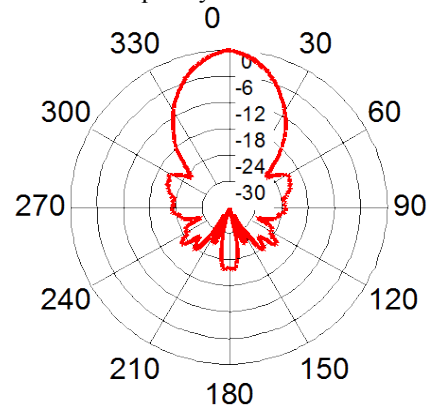
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 32.8KHz frequency

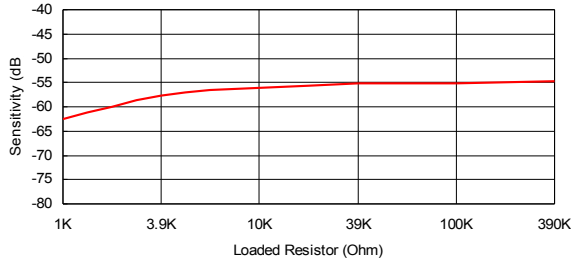


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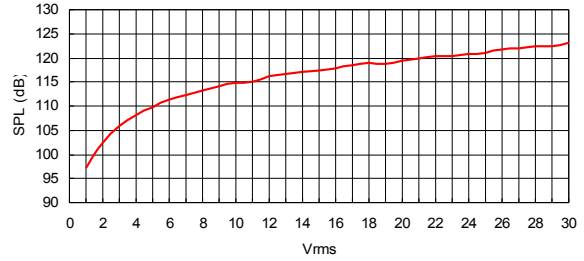
### 328SR180 Receiver

#### Sensitivity Variation vs. Loaded Resistor

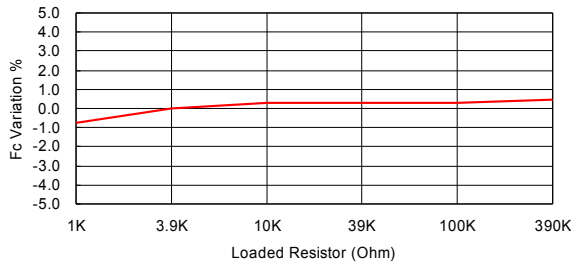


### 328ST180 Transmitter

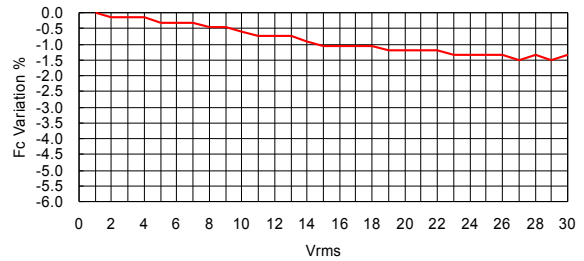
#### SPL Variation vs. Driving Voltage



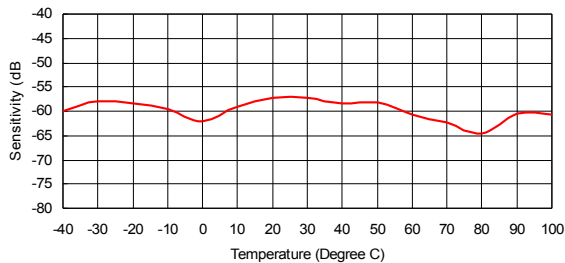
#### Center Frequency Shift vs. Loaded Resistor



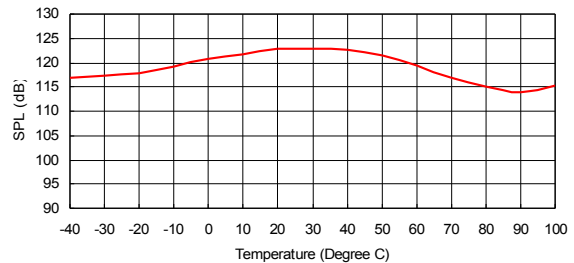
#### Center Frequency Shift vs. Driving Voltage



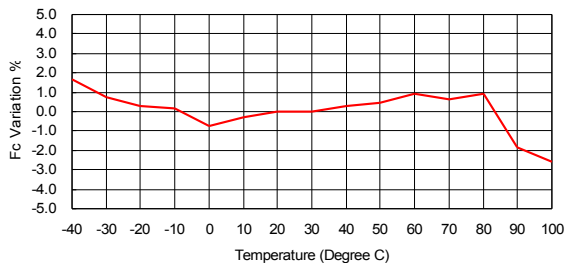
#### Sensitivity Variation vs. Temperature



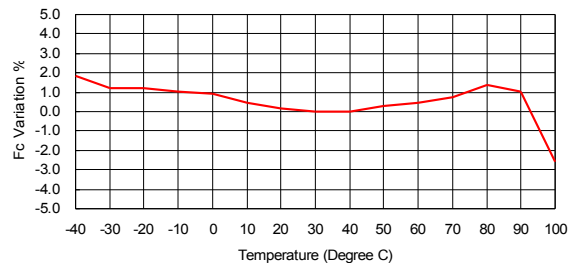
#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



#### Center Frequency Shift vs. Temperature



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## Air Ultrasonic Ceramic Transducers

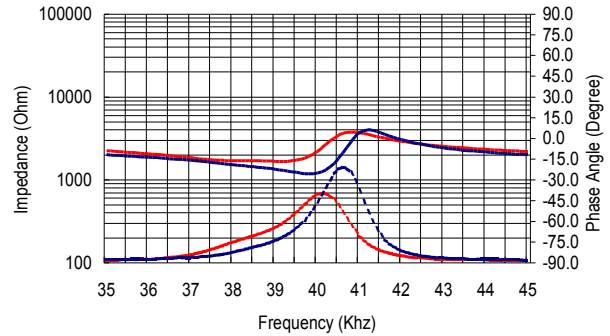
400ST/R100



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400SR100 Impedance —————  
 400SR100 Phase - - - - -  
 400ST100 Impedance —————  
 400ST100 Phase - - - - -



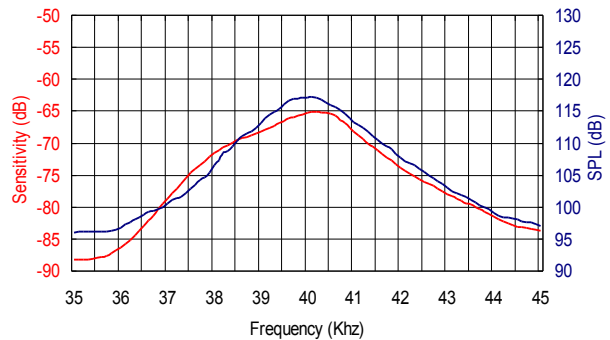
### Specification

400ST100	Transmitter
400SR100	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ST10P 2.5KHz 400SR10P 3.0KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	112dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-67dB min.
Capacitance at 1KHz ±20%	1900 pF
Max. Driving Voltage (cont.)	10Vrms
Total Beam Angle -6dB	72° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

### Sensitivity/Sound Pressure Level

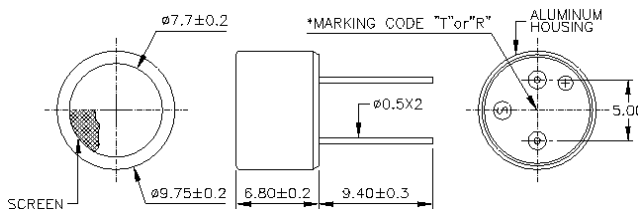
Tested under 10Vrms @30cm



Model available:

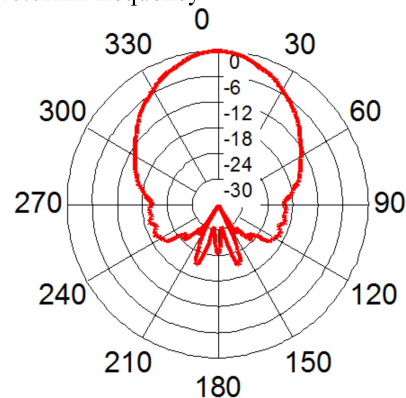
1	400ST/R100	Aluminum Housing
2	400ST/R10P	Plastic Housing

**Dimensions:** Dimensions are in mm



### Beam Angle

Tested at 40.0KHz frequency



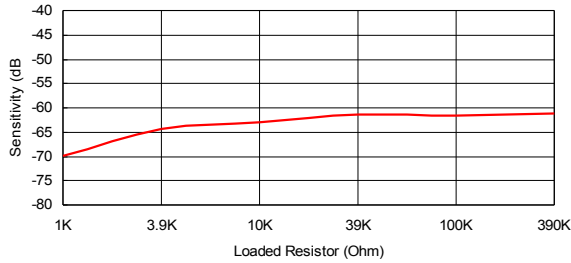
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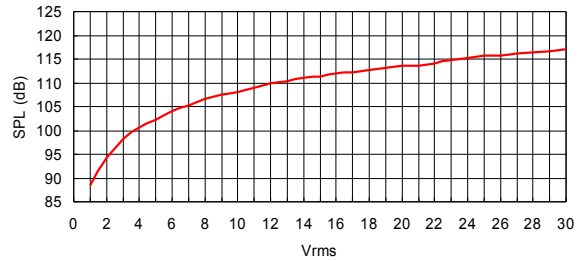
400SR100 Receiver

Sensitivity Variation vs. Loaded Resistor

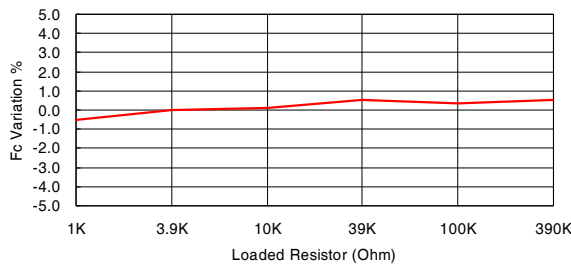


400ST100 Transmitter

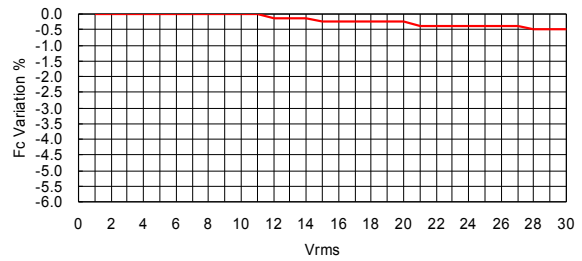
SPL Variation vs. Driving Voltage



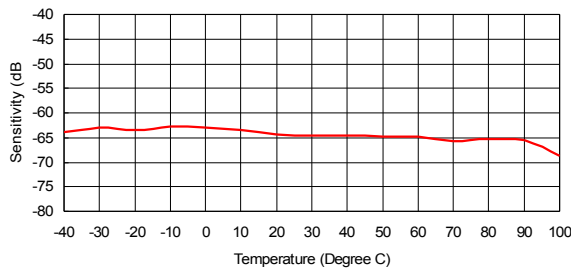
Center Frequency Shift vs. Loaded Resistor



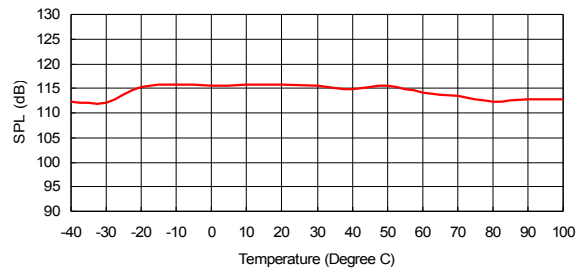
Center Frequency Shift vs. Driving Voltage



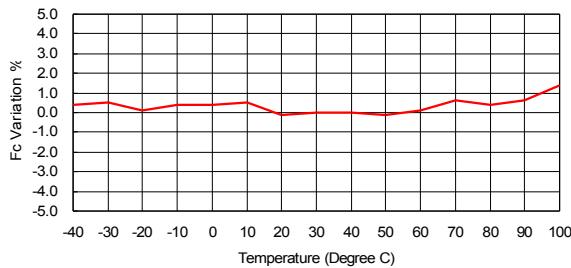
Sensitivity Variation vs. Temperature



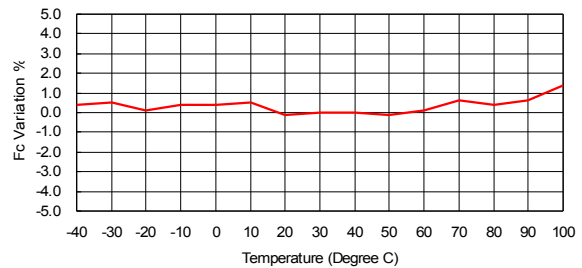
SPL Variation vs. Temperature



Center Frequency Shift vs. Temperature



Center Frequency Shift vs. Temperature



## Air Ultrasonic Ceramic Transducers

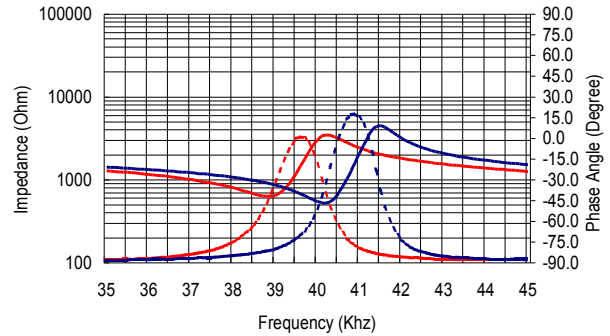
400ST/R120



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400SR120 Impedance ——— (Red solid line)  
 400SR120 Phase - - - - - (Red dashed line)  
 400ST120 Impedance ——— (Blue solid line)  
 400ST120 Phase - - - - - (Blue dashed line)



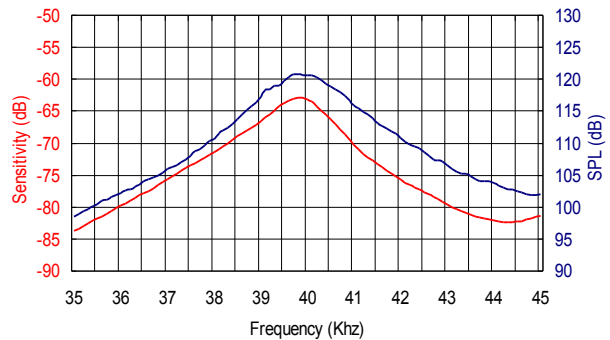
### Specification

400ST120	Transmitter
400SR120	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ST120 2.0KHz 400SR120 2.0KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	115dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-67dB min.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	85° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

### Sensitivity/Sound Pressure Level

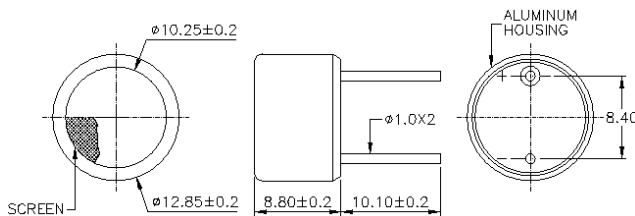
Tested under 10Vrms @30cm



Model available:

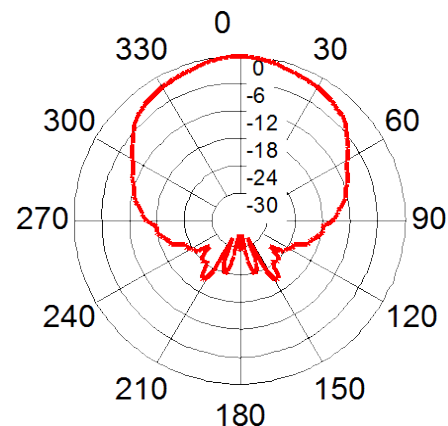
1	400ST/R120	Aluminum Housing
2	400ST/R12B	Black Al. Housing

**Dimensions:** dimensions are in mm



### Beam Angle

Tested at 40.0KHz frequency

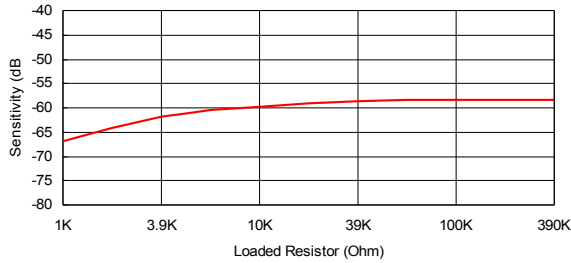


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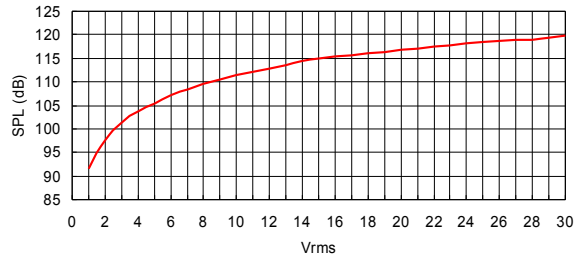
400SR120 Receiver

Sensitivity Variation vs. Loaded Resistor

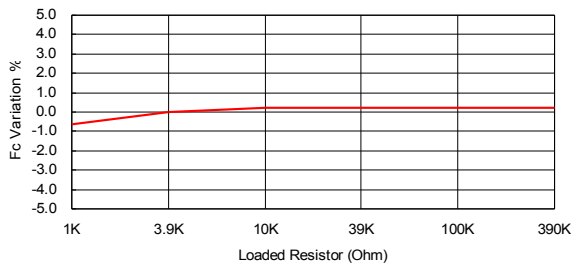


400ST120 Transmitter

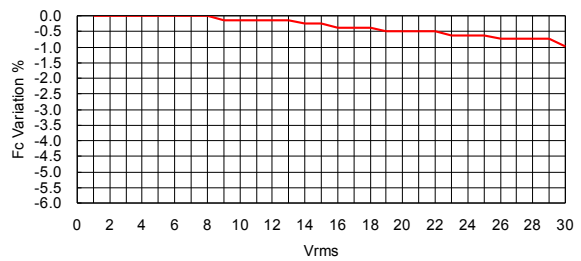
SPL Variation vs. Driving Voltage



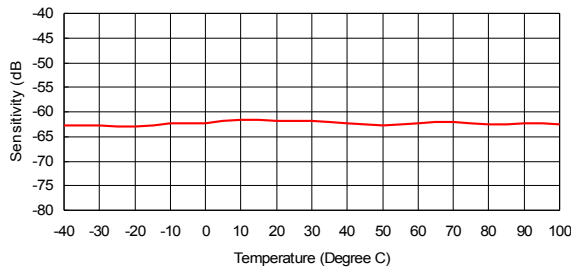
Center Frequency Shift vs. Loaded Resistor



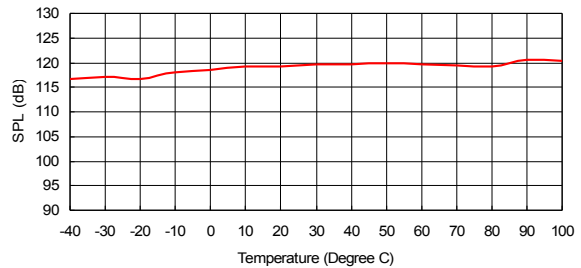
Center Frequency Shift vs. Driving Voltage



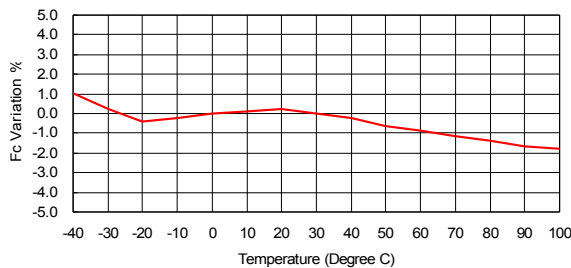
Sensitivity Variation vs. Temperature



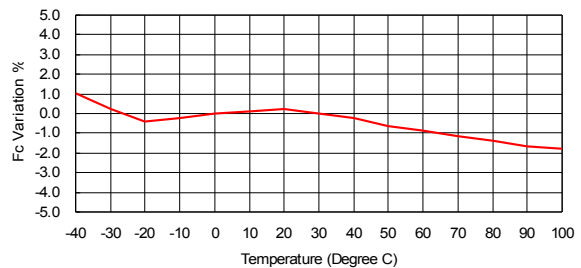
SPL Variation vs. Temperature



Center Frequency Shift vs. Temperature



Center Frequency Shift vs. Temperature



## Air Ultrasonic Ceramic Transducers

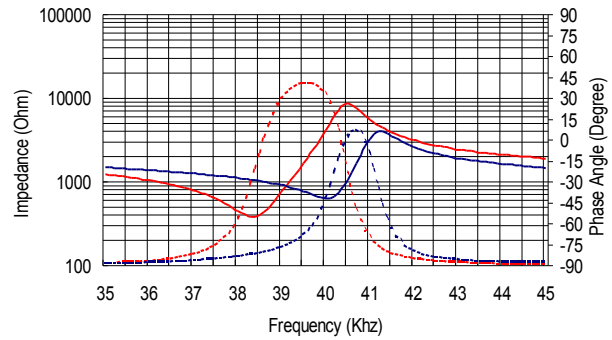
400ST/R160



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400SR160 Impedance (Red solid line)  
 400SR160 Phase (Red dashed line)  
 400ST160 Impedance (Blue solid line)  
 400ST160 Phase (Blue dashed line)



### Specification

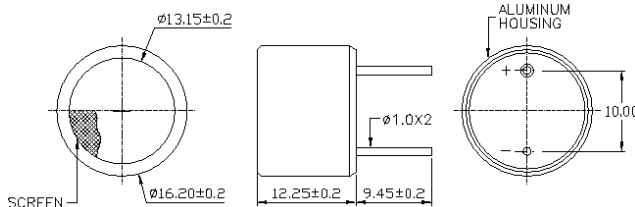
400ST160	Transmitter
400SR160	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ST160: 2.0KHz 400SR160: 2.5KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	120dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-61dB min.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	55° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Models available:

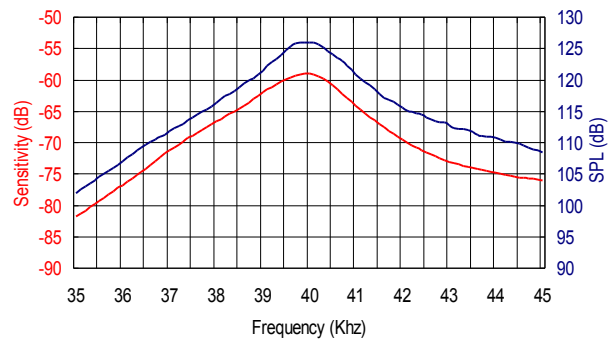
1	400ST/R160	Aluminum Housing
2	400ST/R16B	Black Al. Housing
3	400ST/R16P	Plastic Housing

**Dimensions:** dimensions are in mm



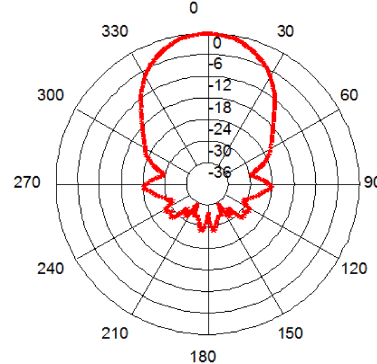
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



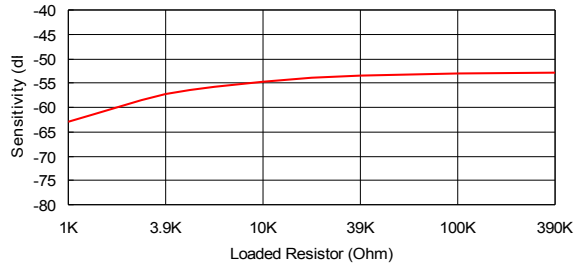
### Beam Angle

Tested at 40.0KHz frequency



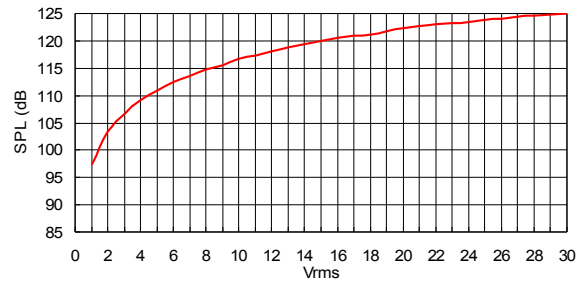
### 400SR160 Receiver

#### Sensitivity Variation vs. Loaded Resistor

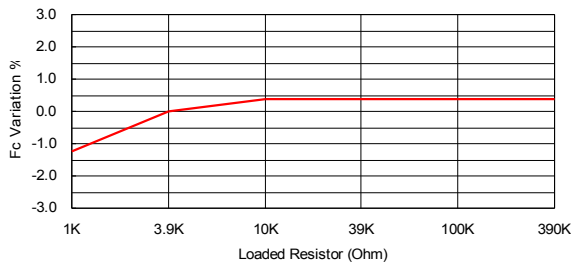


### 400ST160 Transmitter

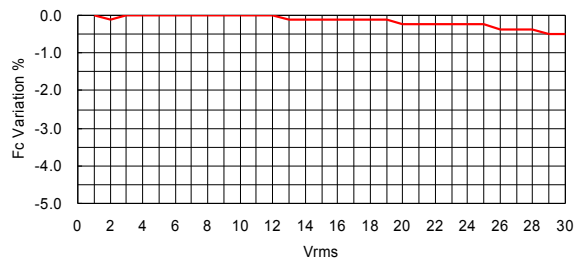
#### SPL Variation vs. Driving Voltage



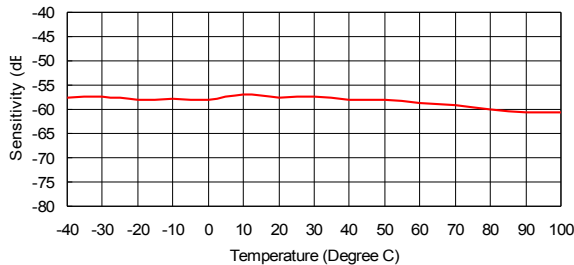
#### Center Frequency Shift vs. Loaded Resistor



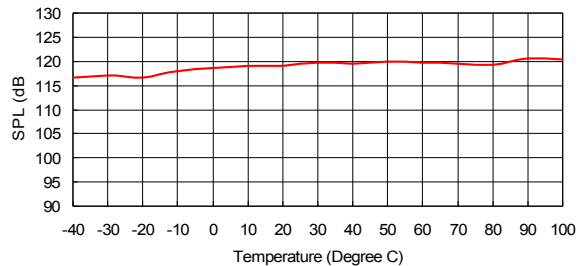
#### Center Frequency Shift vs. Driving Voltage



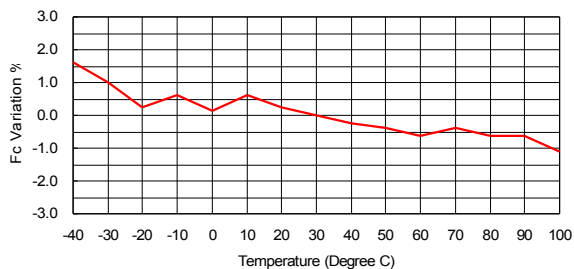
#### Sensitivity Variation vs. Temperature



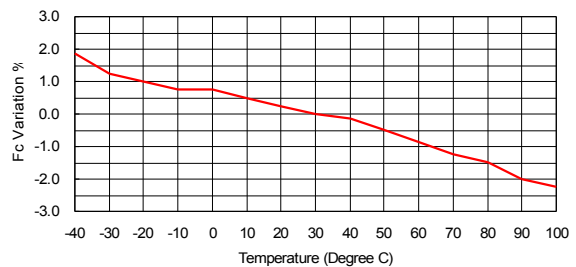
#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



#### Center Frequency Shift vs. Temperature



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## Air Ultrasonic Ceramic Transducers

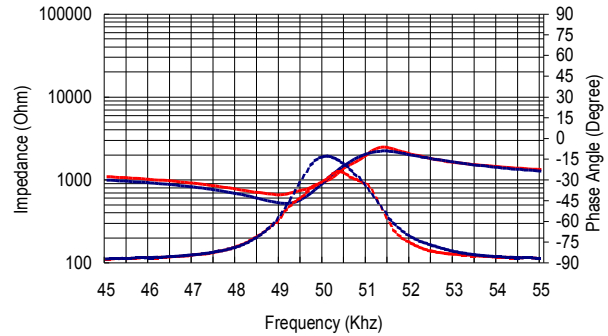
500MB120



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

Receiver Impedance ————— (Red solid line)  
 Receiver Phase - - - - - (Red dashed line)  
 Transmitter Impedance ————— (Blue solid line)  
 Transmitter Phase - - - - - (Blue dashed line)



### Specification

500MB120

Center Frequency

Bandwidth (-6dB)

Transmitting Sound Pressure Level  
 at 50.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm

Receiving Sensitivity

at 50.0KHz 0dB = 1 volt/μbar

Sensitivity/Cross Talk Ratio

Nominal Impedance (Trans.)

Capacitance at 1KHz ±20%

Max. Driving Voltage (cont.)

Total Beam Angle -6dB

Operation Temperature

Storage Temperature

Dual

Transducer

50.0±1.0KHz

3KHz

113dB min.

-67dB min.

15 dB

800 Ohm

2400 pF

20Vrms

30° typical

-30 to 70°C

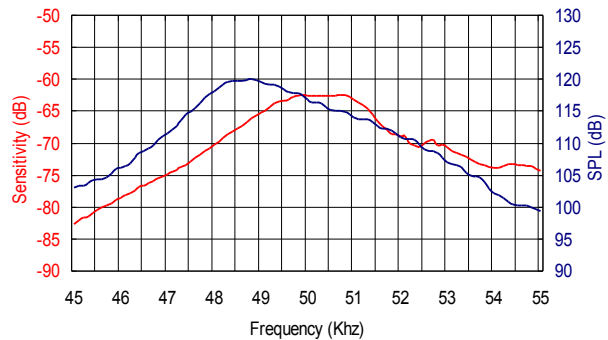
-40 to 80°C

All specification taken typical at 25°C

Closer frequency tolerance can be supplied upon request.

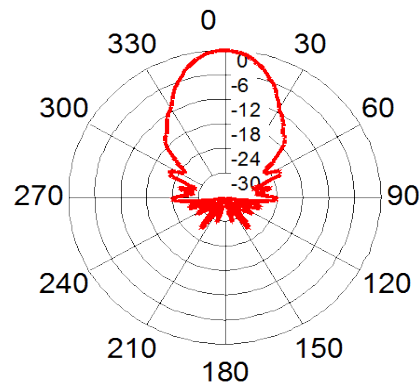
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm

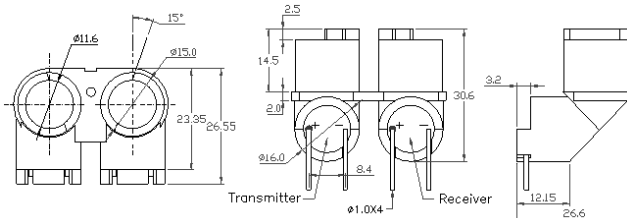


### Beam Angle

Tested at 50.0KHz frequency



**Dimensions:** dimensions are in mm



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### Specification

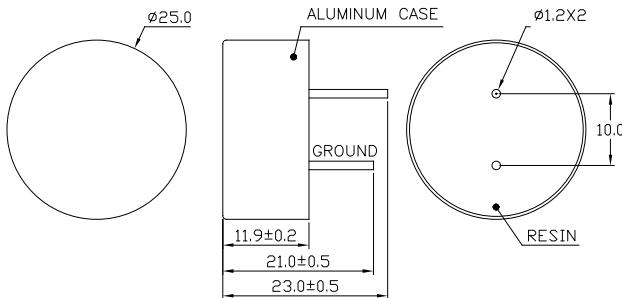
250ET250	Transmitter
250ER250	Receiver
Center Frequency	25.0±1.0KHz
Bandwidth (-6dB)	250ET250 1.0KHz 250ER250 1.0KHz
Transmitting Sound Pressure Level at 25.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	113dB min.
Receiving Sensitivity at 25.0KHz 0dB = 1 volt/μbar	-63dB min.
Capacitance at 1KHz ±20%	2800 pF
Max. Driving Voltage (cont.)	15Vrms
Total Beam Angle -6dB	40° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
Closer frequency tolerance can be supplied upon request.

Model available:

1	250ET/R250	Aluminum Housing
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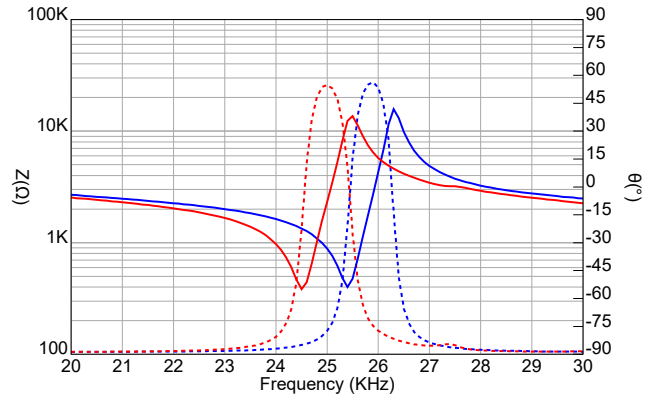
**Dimensions:** dimensions are in mm



### Impedance/Phase Angle vs. Frequency

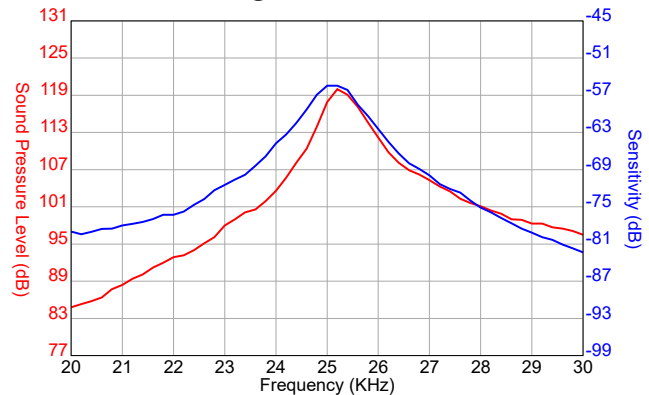
Tested under 1Vrms Oscillation Level

250ER250 Impedance (Red solid line)  
250ER250 Phase (Red dashed line)  
250ET250 Impedance (Blue solid line)  
250ET250 Phase (Blue dashed line)



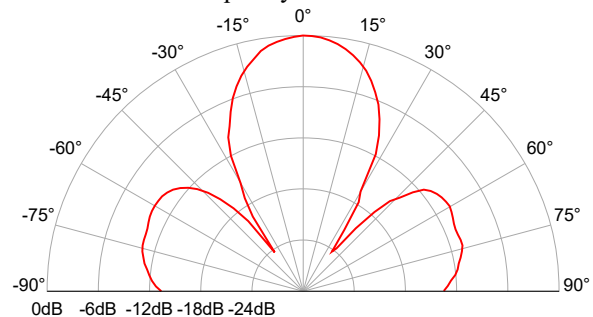
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 25.0Khz frequency

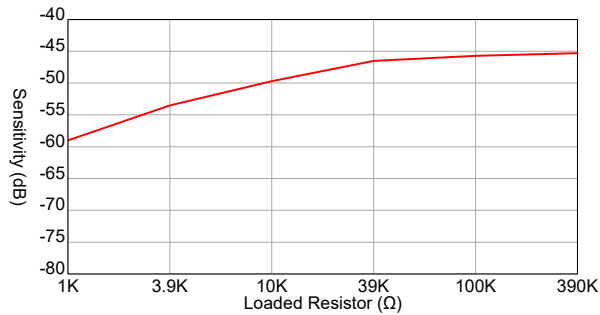


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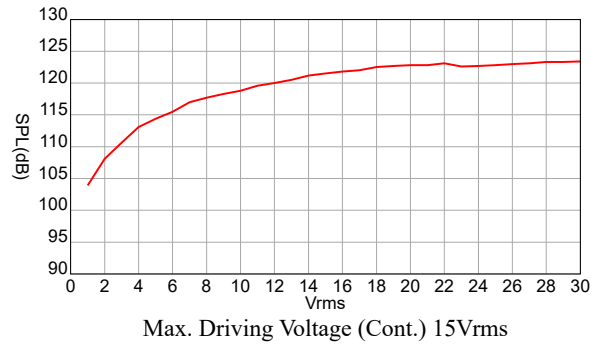
**250ER250 Receiver**

**Sensitivity Variation vs. Loaded Resistor**

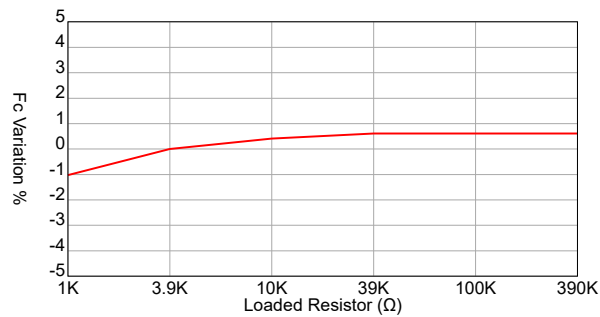


**250ET250 Transmitter**

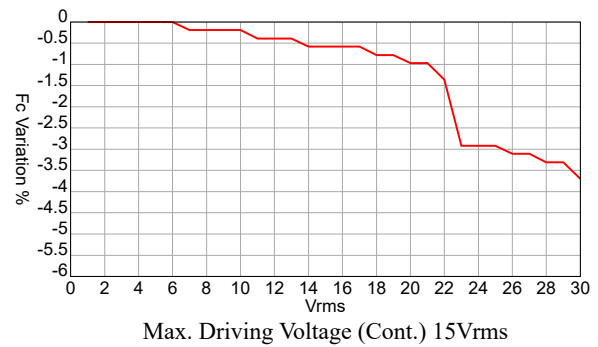
**SPL Variation vs. Driving Voltage**



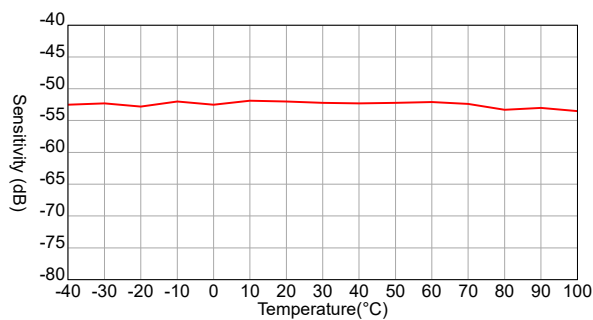
**Center Frequency Shift vs. Loaded Resistor**



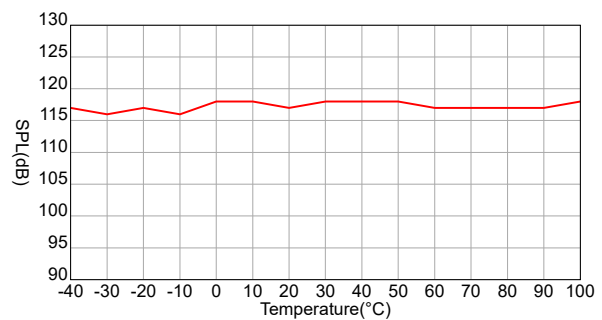
**Center Frequency Shift vs. Driving Voltage**



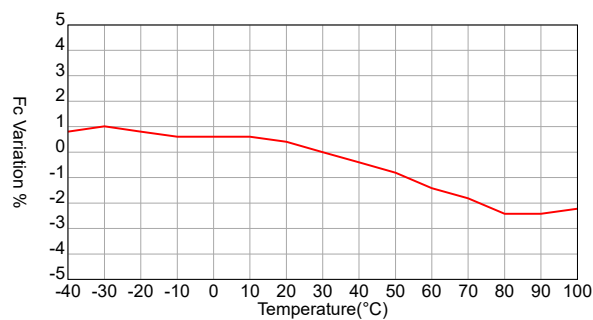
**Sensitivity Variation vs. Temperature**



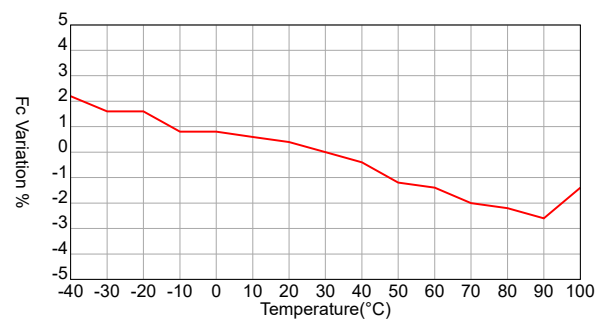
**SPL Variation vs. Temperature**



**Center Frequency Shift vs. Temperature**



**Center Frequency Shift vs. Temperature**



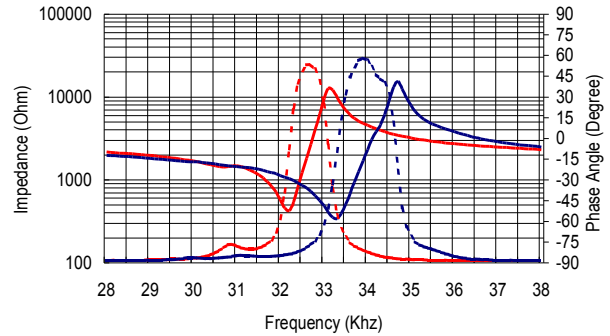




### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

328ER250 Impedance ————  
 328ER250 Phase - - - - -  
 328ET250 Impedance ————  
 328ET250 Phase - - - - -



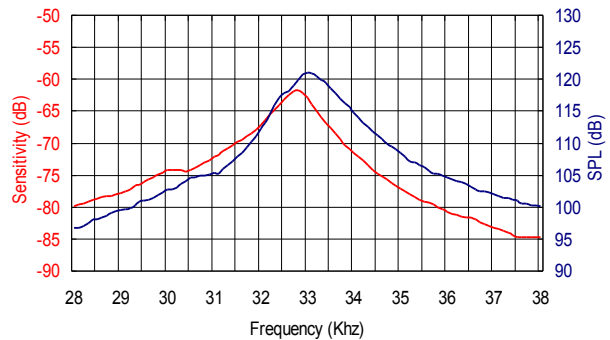
### Specification

328ET250	Transmitter
328ER250	Receiver
Center Frequency	32.8±1.0KHz
Bandwidth (-6dB)	328ET250 1.0KHz 328ER250 1.0KHz
Transmitting Sound Pressure Level at 32.8KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	113dB min. 107dB min. SUS 316
Receiving Sensitivity at 32.8KHz 0dB = 1 volt/μbar	-67dB min. -70dB min. SUS 316
Capacitance at 1KHz	±20% 2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle	-6dB 33° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

### Sensitivity/Sound Pressure Level

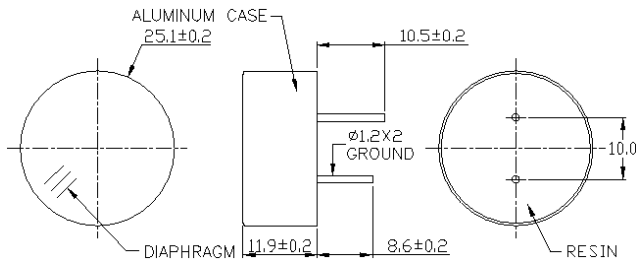
Tested under 10Vrms @30cm



Model available:

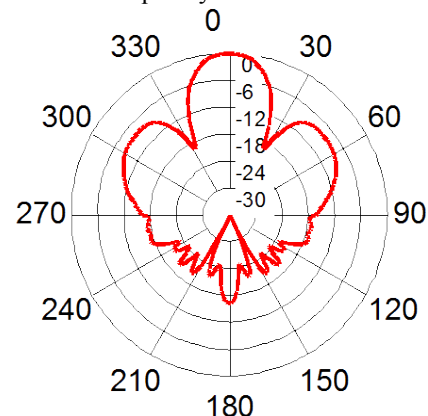
1	328ET/R250	Aluminum Housing
2	328ET/R250B	Black Alum. Housing
3	328ET/R250S	SUS 316 Housing

**Dimensions:** dimensions are in mm



### Beam Angle

Tested at 32.8KHz frequency

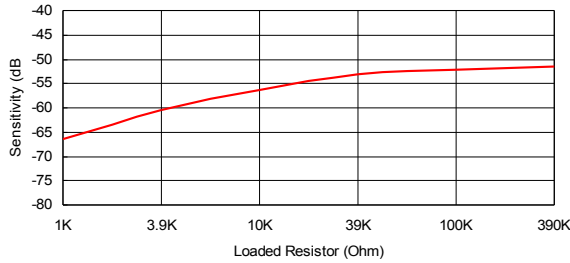


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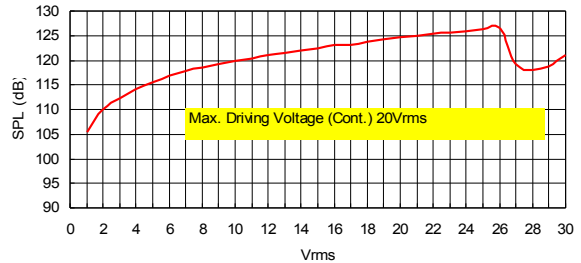
328ER250 Receiver

Sensitivity Variation vs. Loaded Resistor

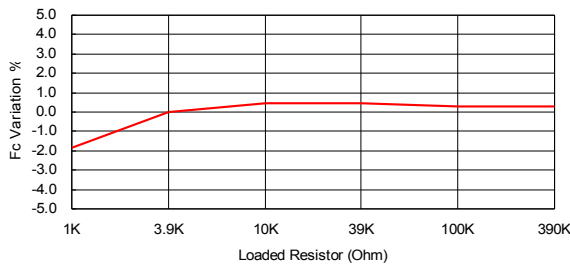


328ET250 Transmitter

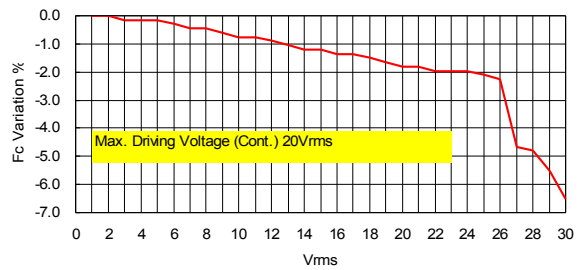
SPL Variation vs. Driving Voltage



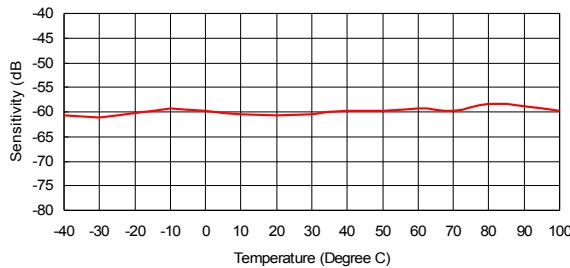
Center Frequency Shift vs. Loaded Resistor



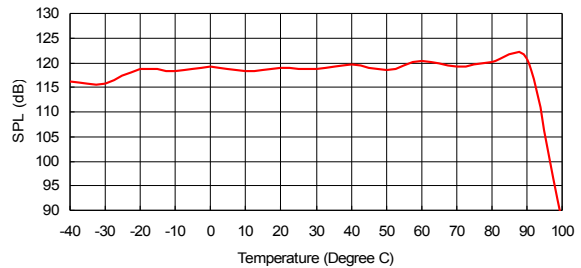
Center Frequency Shift vs. Driving Voltage



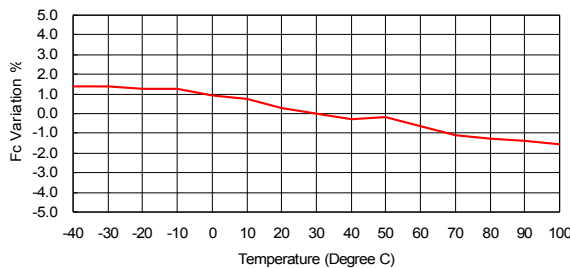
Sensitivity Variation vs. Temperature



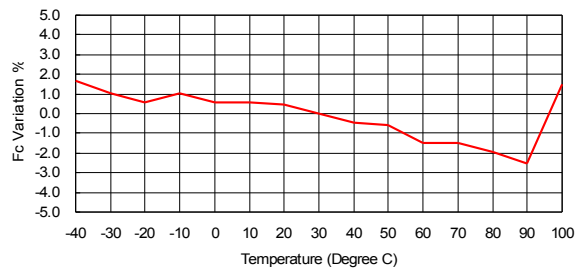
SPL Variation vs. Temperature



Center Frequency Shift vs. Temperature

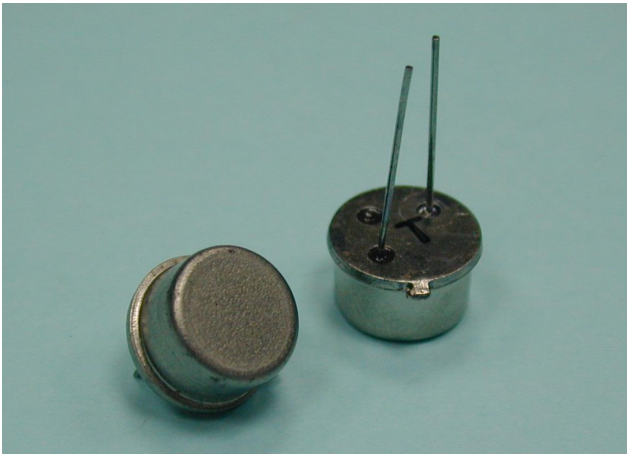


Center Frequency Shift vs. Temperature



## Air Ultrasonic Ceramic Transducers

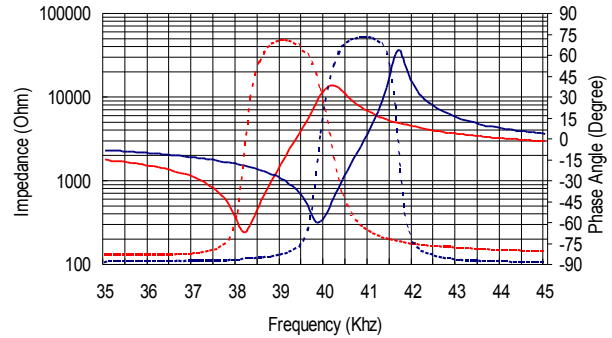
400ET/R080



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400ER080 Impedance ——— (Red solid line)  
 400ER080 Phase - - - - - (Red dashed line)  
 400ET080 Impedance ——— (Blue solid line)  
 400ET080 Phase - - - - - (Blue dashed line)



### Specification

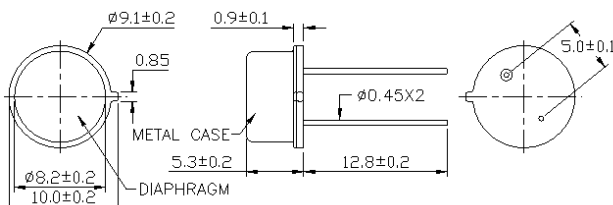
400ET080	Transmitter
400ER080	Receiver
Center Frequency	40.0±3.0KHz
Bandwidth (-6dB)	400ET080 1.5KHz 400ER080 2.0KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	100dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-80dB min.
Capacitance at 1KHz ±20%	1700 pF
Max. Driving Voltage (cont.)	15Vrms
Total Beam Angle -6dB	125° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

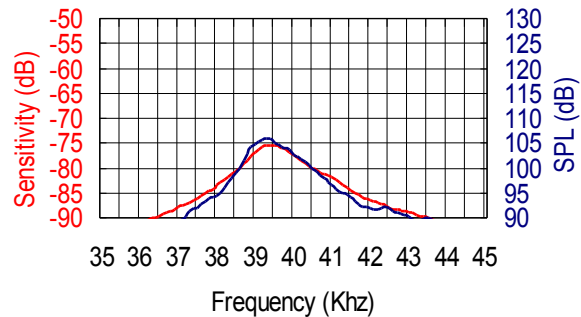
1	400ET/R080	Nickel Plated Steel Housing
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**Dimensions:** dimensions are in mm



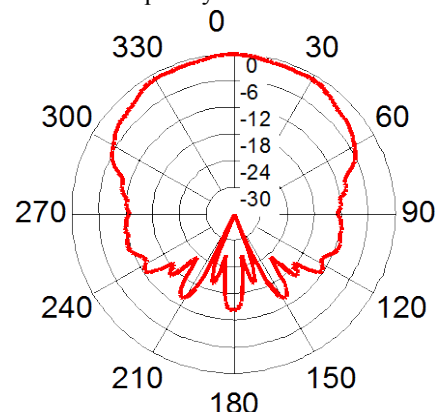
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 40.0KHz frequency

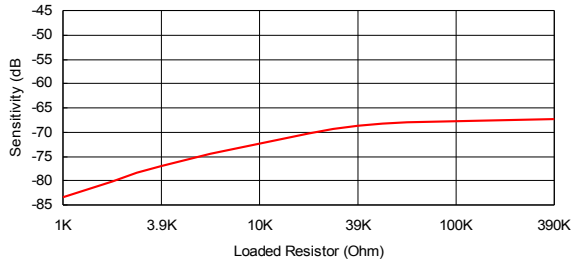


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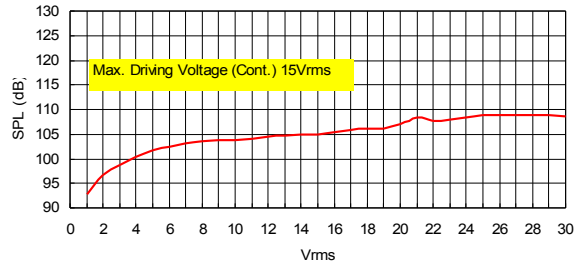
400ER080 Receiver

Sensitivity Variation vs. Loaded Resistor

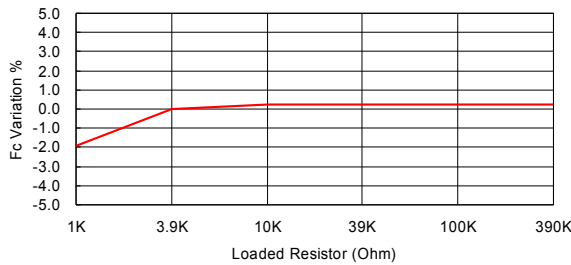


400ET080 Transmitter

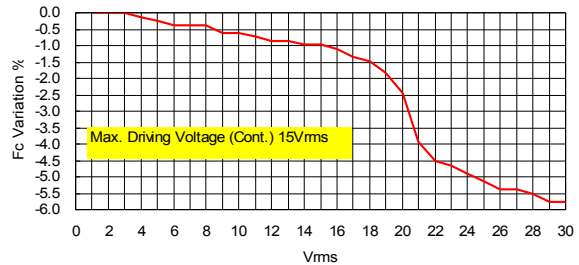
SPL Variation vs. Driving Voltage



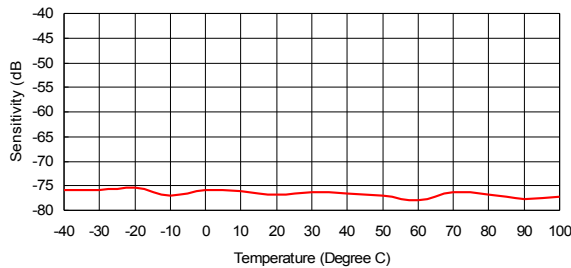
Center Frequency Shift vs. Loaded Resistor



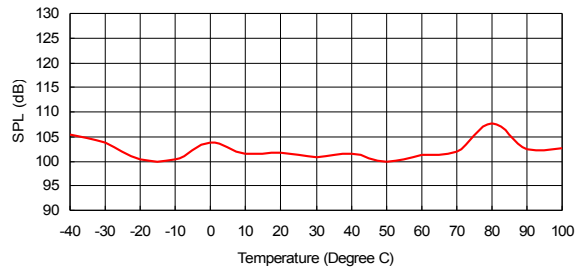
Center Frequency Shift vs. Driving Voltage



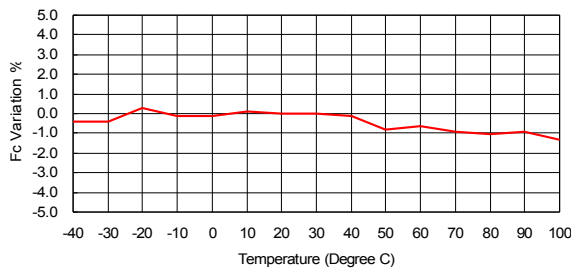
Sensitivity Variation vs. Temperature



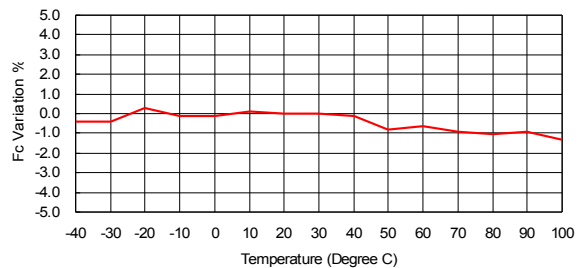
SPL Variation vs. Temperature



Center Frequency Shift vs. Temperature



Center Frequency Shift vs. Temperature

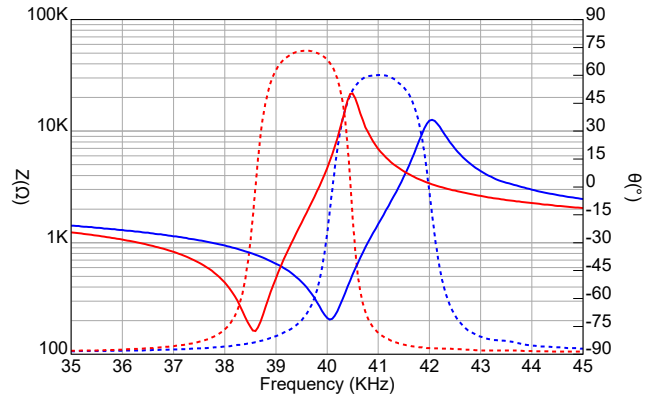




### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400ER250 Impedance (Red solid line)  
 400ER250 Phase (Red dashed line)  
 400ET250 Impedance (Blue solid line)  
 400ET250 Phase (Blue dashed line)



### Specification

400ET250	Transmitter
400ER250	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ET250 1.0KHz 400ER250
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	115dB min. 107 dB min. for SUS316
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-70dB min. -72 dB min. for SUS316
Capacitance at 1KHz	±20% 2800 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle	-6dB 30° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

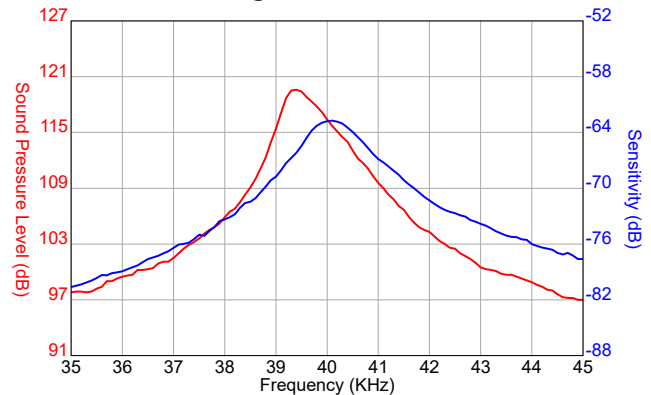
All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

1	400ET/R250	Aluminum Housing
2	400ET/R25B	Black Alum. Housing
3	400ET/R25S	SUS316 Housing

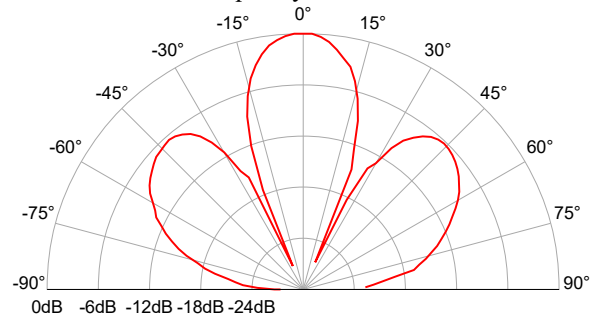
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm

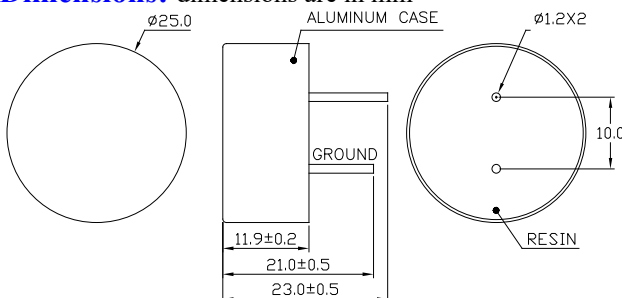


### Beam Angle

Tested at 40.0KHz Frequency



Dimensions: dimensions are in mm

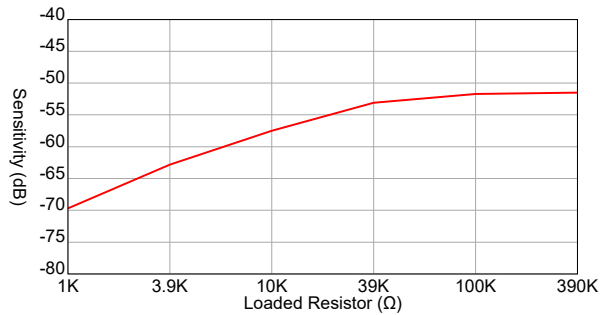


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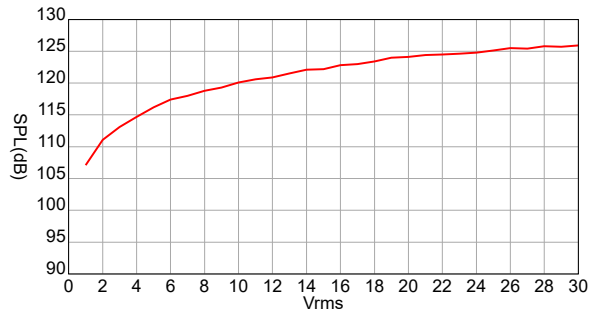
**400ER250 Receiver**

**Sensitivity Variation vs. Loaded Resistor**

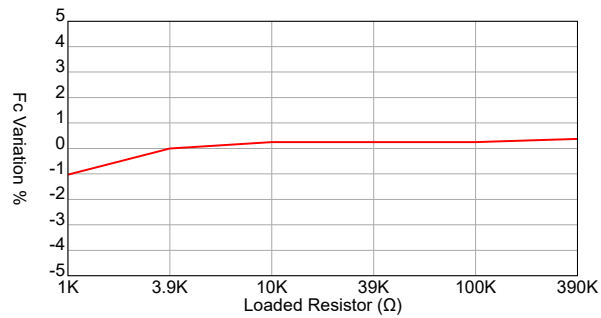


**400ET250 Transmitter**

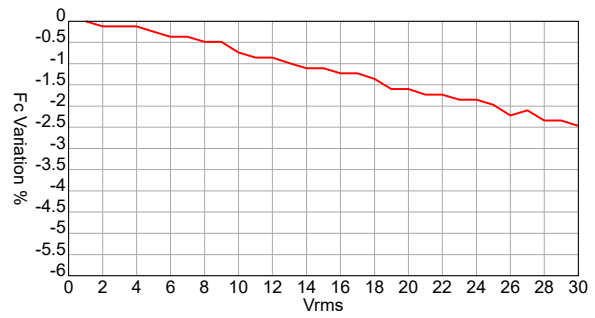
**SPL Variation vs. Driving Voltage**



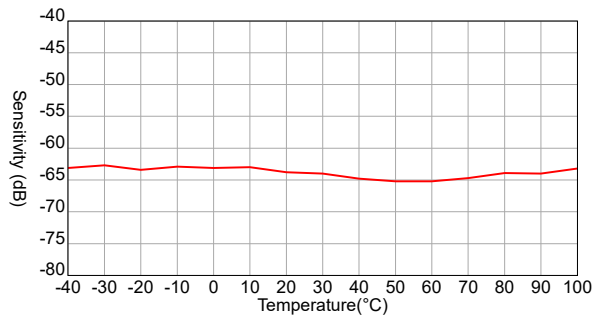
**Center Frequency Shift vs. Loaded Resistor**



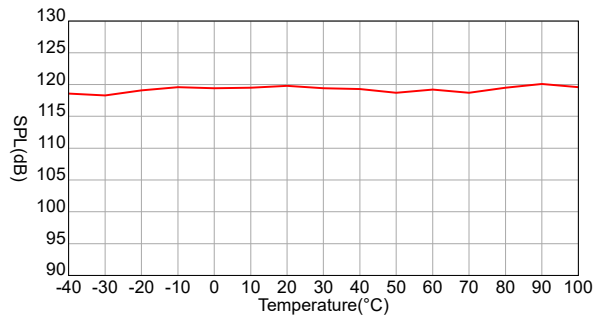
**Center Frequency Shift vs. Driving Voltage**



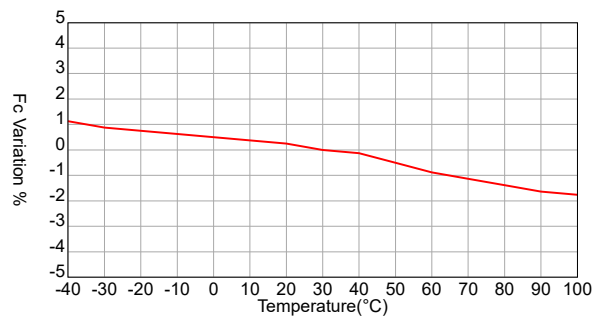
**Sensitivity Variation vs. Temperature**



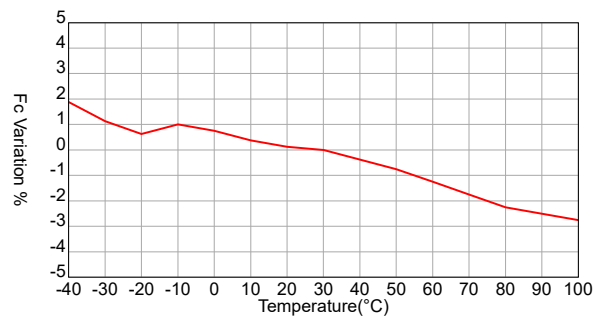
**SPL Variation vs. Temperature**



**Center Frequency Shift vs. Temperature**



**Center Frequency Shift vs. Temperature**



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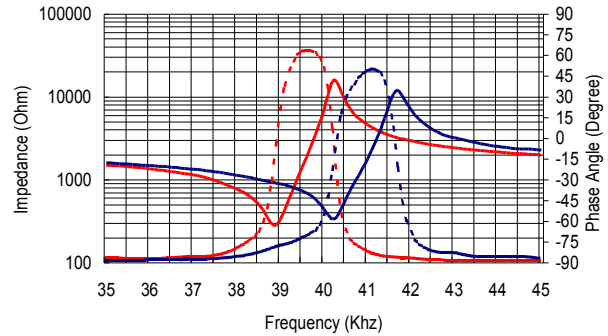
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### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400ER180 Impedance —————  
 400ER180 Phase - - - - -  
 400ET180 Impedance —————  
 400ET180 Phase - - - - -



### Specification

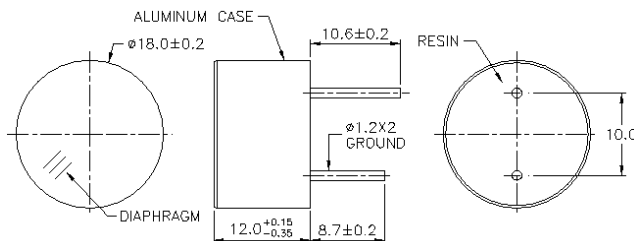
400ET180	Transmitter
400ER180	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ET180 1.5KHz 400ER180 1.5KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002µbar per 10Vrms at 30cm	115dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/µbar	-70dB min.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	15Vrms
Total Beam Angle -6dB	30° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
 Closer frequency tolerance can be supplied upon request.

Model available:

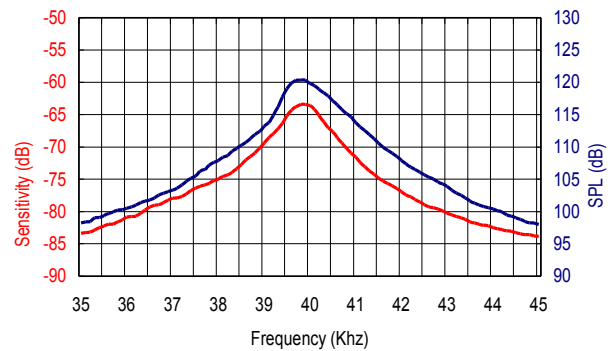
1	400ET/R180	Aluminum Housing
2	400ET/R18B	Black Alum. Housing

**Dimensions:** dimensions are in mm



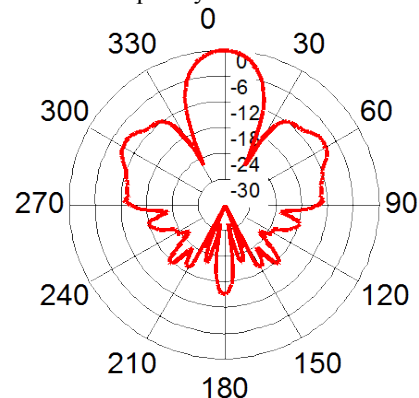
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 40.0KHz frequency

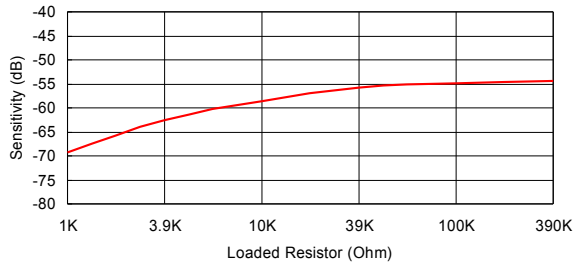


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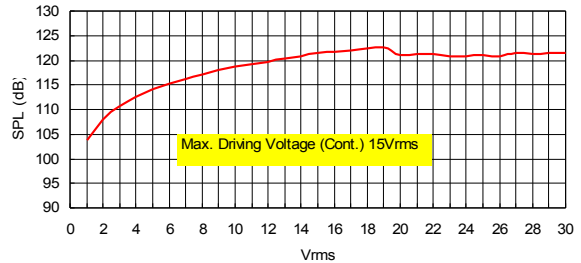
### 400ER180 Receiver

#### Sensitivity Variation vs. Loaded Resistor

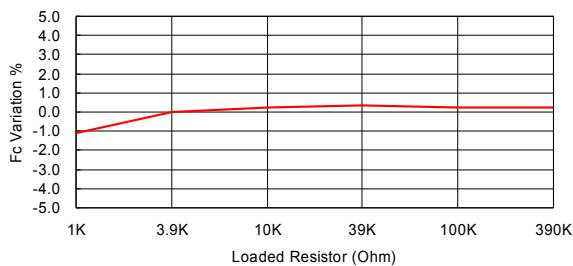


### 400ET180 Transmitter

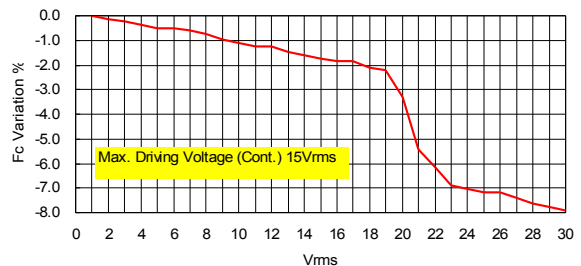
#### SPL Variation vs. Driving Voltage



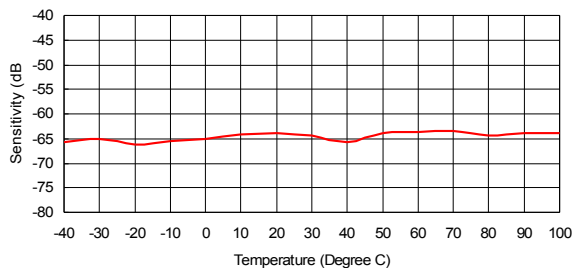
#### Center Frequency Shift vs. Loaded Resistor



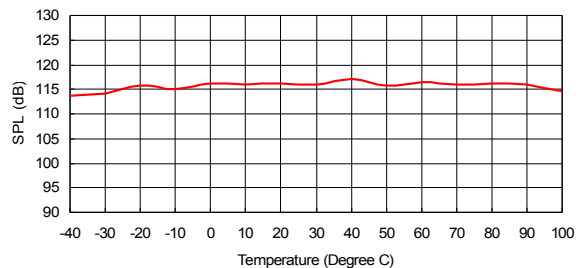
#### Center Frequency Shift vs. Driving Voltage



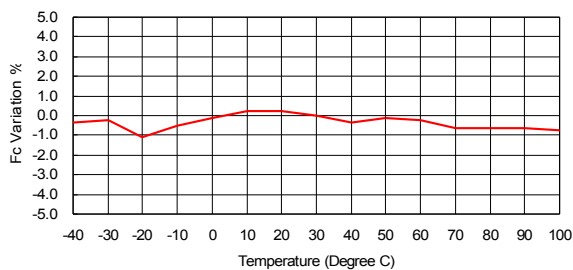
#### Sensitivity Variation vs. Temperature



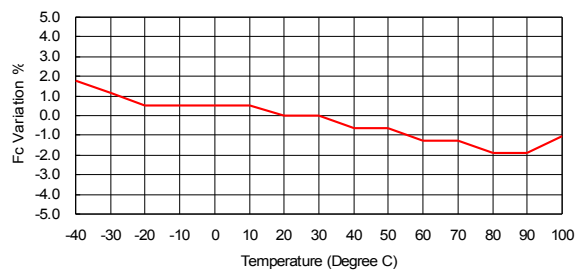
#### SPL Variation vs. Temperature



#### Center Frequency Shift vs. Temperature



#### Center Frequency Shift vs. Temperature



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## Air Ultrasonic Ceramic Transducers

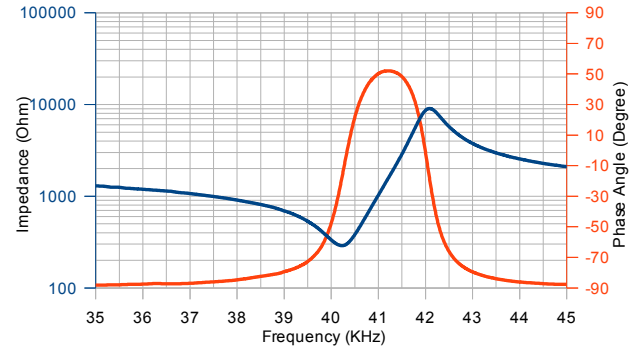
400ET/R18S



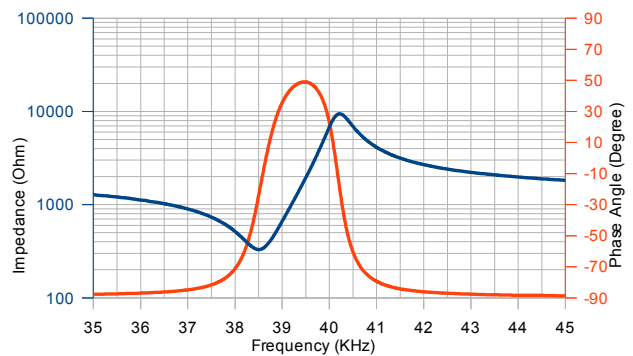
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

400ET18S



400ER18S



### Specification

400ET18S	Transmitter
400ER18S	Receiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400ET18S 1.5KHz 400ER18S 1.5KHz
Transmitting Sound Pressure Level at 40.0KHz; 0dB re 0.0002μbar per 10Vrms at 30cm	110dB min.
Receiving Sensitivity at 40.0KHz 0dB = 1 volt/μbar	-70dB min.
Capacitance at 1KHz ±20%	2900 pF
Max. Driving Voltage (cont.)	15Vrms
Total Beam Angle (-6dB Main Beam)	35° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

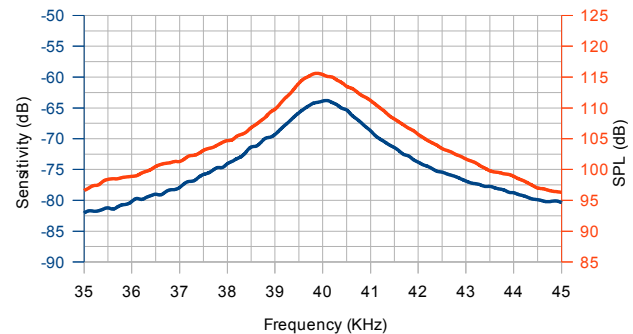
All specification taken typical at 25°C  
Closer frequency tolerance can be supplied upon request.

Model available:

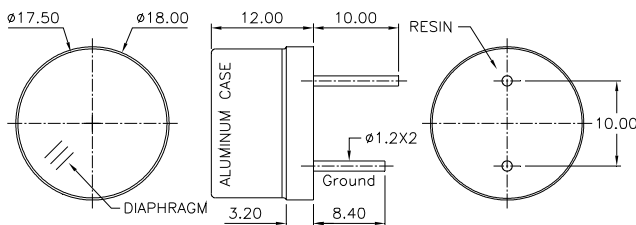
1	400ET/R18S	Aluminum Housing
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### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm

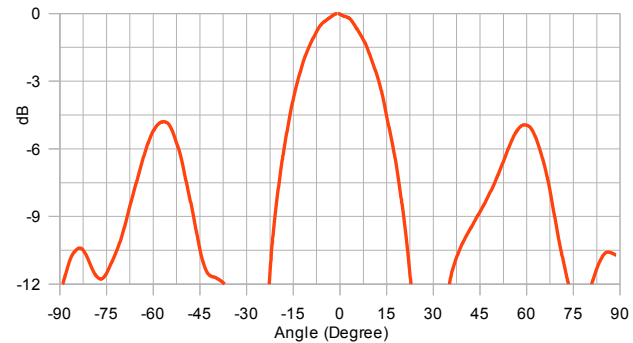


**Dimensions:** dimensions are in mm



### Beam Angle

Tested at 40.0KHz frequency

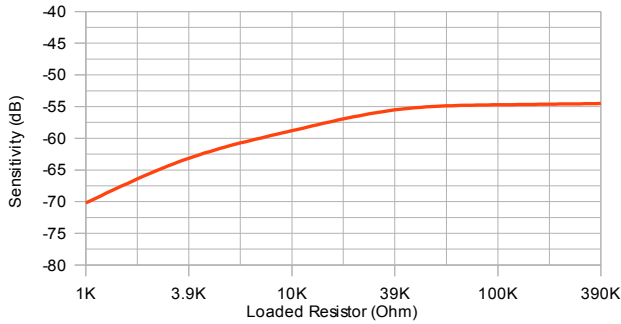


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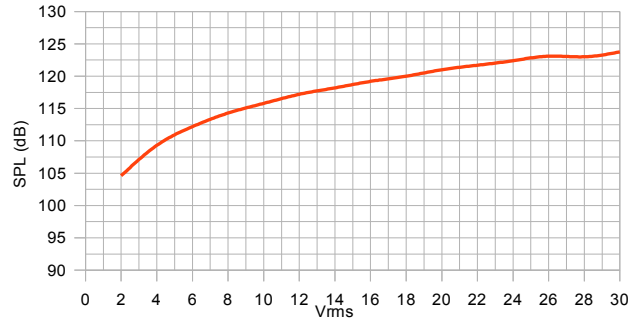
400ER180 Receiver

Sensitivity Variation vs. Loaded Resistor

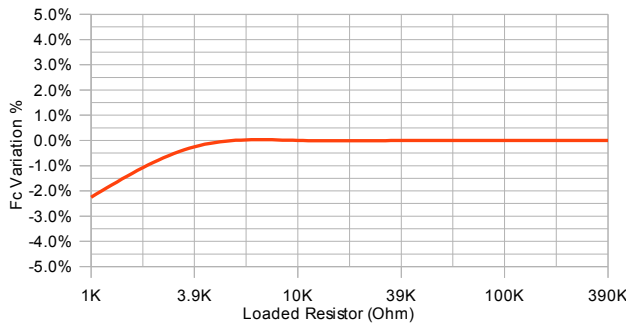


400ET180 Transmitter

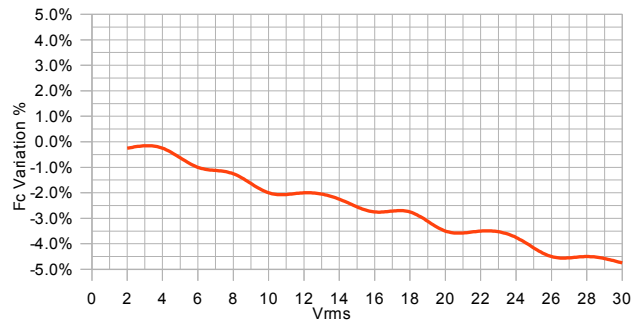
SPL Variation vs. Driving Voltage



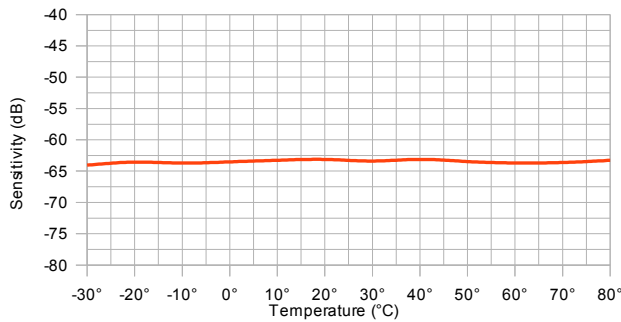
Center Frequency Shift vs. Loaded Resistor



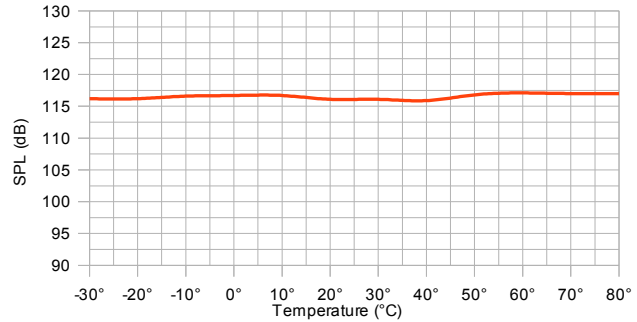
Center Frequency Shift vs. Driving Voltage



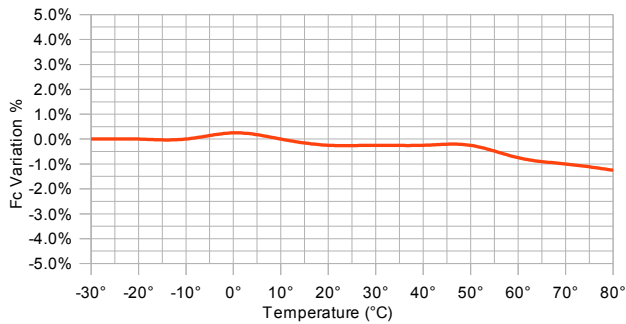
Sensitivity Variation vs. Temperature



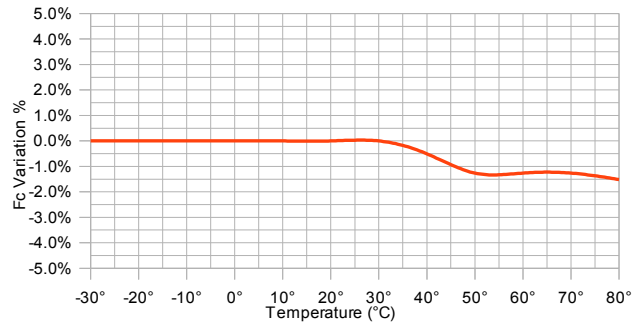
SPL Variation vs. Temperature



Center Frequency Shift vs. Temperature



Center Frequency Shift vs. Temperature



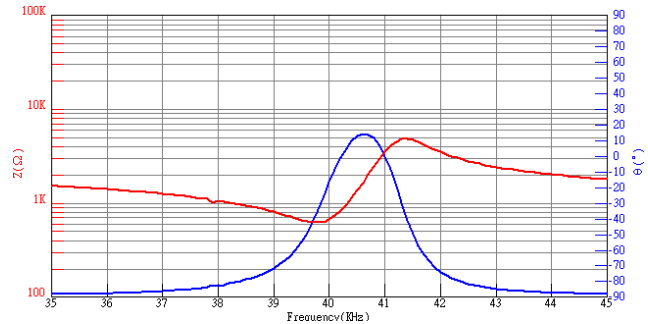
## Air Ultrasonic Ceramic Transducers

400PT120



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

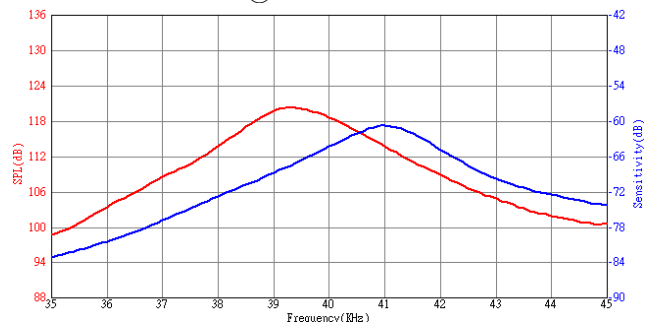


### Specification

400PT120	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400PT120 2.0KHz
Transmitting Sound Pressure Level at resonant frequency ; 0dB re 0.0002μbar per 10Vrms at 30cm	115dB min.
Receiving Sensitivity at resonant frequency ; 0dB = 1 volt/μbar	-68dB min.
Nominal Impedance (Ω)	1000
Ring (ms)	1.2 max.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle	400PT120 85° typical
	400PT12P 120° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

### Sensitivity/Sound Pressure Level

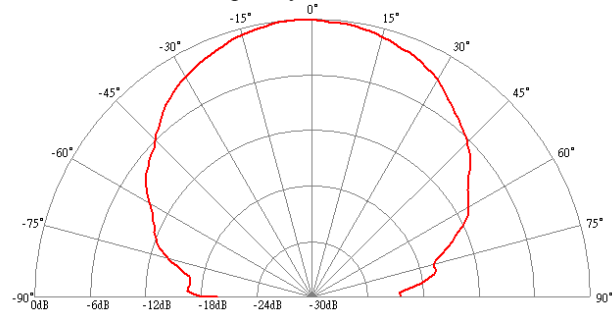
Tested under 10Vrms @30cm



All specification taken typical at 25°C  
Closer frequency tolerance, shorter ringing and wider bandwidth models can be supplied upon request.

### Beam Angle

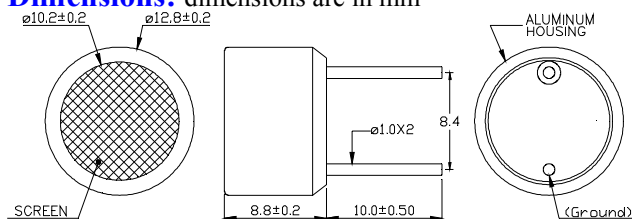
Tested at 40.0KHz frequency



Model available:

1	400PT120	Aluminum Housing
2	400PT12B	Black Al. Housing
3	400PT12P	Plastic Housing

**Dimensions:** dimensions are in mm



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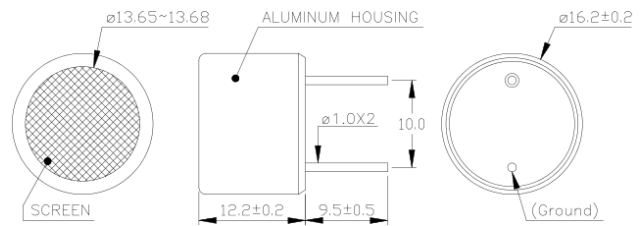
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## Air Ultrasonic Ceramic Transducers

400PT160



**Dimensions:** dimensions are in mm



### Specification

400PT160	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400PT160 2.0KHz
Transmitting Sound Pressure Level at resonant frequency; 0dB re 0.0002μbar per 10Vrms at 30cm	117dB min.
Receiving Sensitivity at resonant frequency 0dB = 1 volt/μbar	-65dB min.
Nominal Impedance (Ohm)	1000
Ringling (ms) max.	1.2 – PT160 1.5 – PT16P
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage (cont.)	20Vrms
Total Beam Angle -6dB	40° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

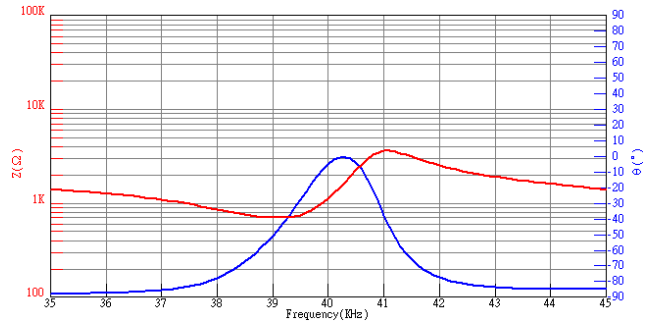
All specification taken typical at 25°C  
Closer frequency tolerance, shorter ringling and wider bandwidth models can be supplied upon request.

Model available:

1	400PT160	Aluminum Housing
2	400PT16P	Plastic Housing

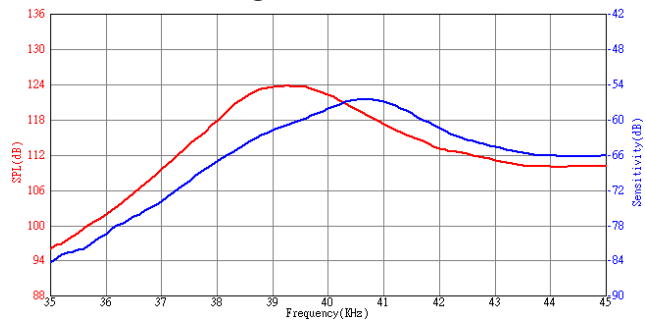
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



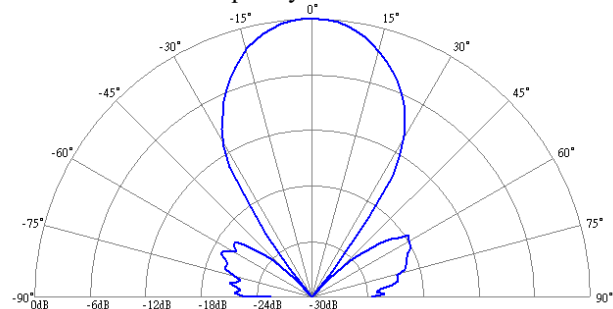
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle

Tested at 40.0Khz frequency

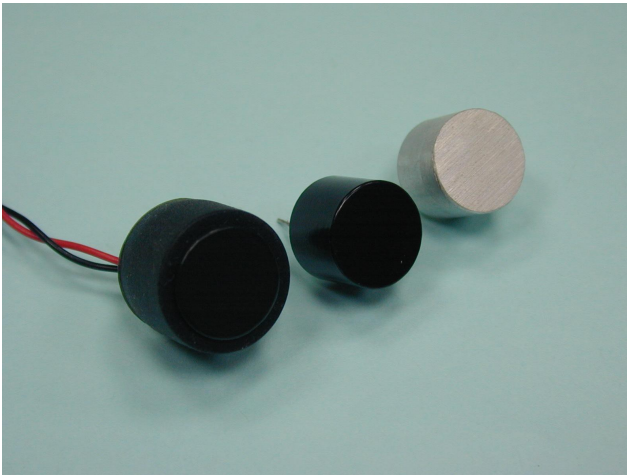


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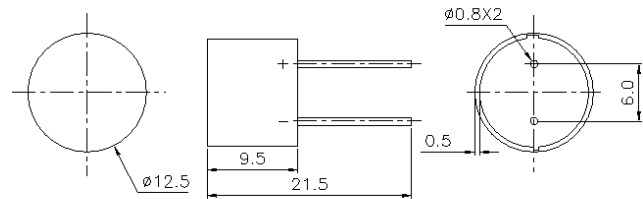
[Http://www.pro-wave.com.tw](http://www.pro-wave.com.tw) ; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw) ; Tel: 886-2-22465101 ; Fax: 886-2-22465105

**Air Ultrasonic Ceramic Transducers**

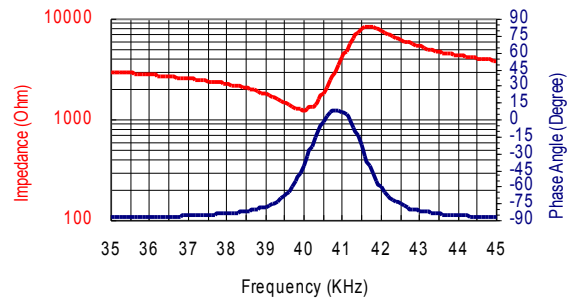
**400EP125**



**Dimensions:** dimensions are in mm



**Impedance/Phase Angle vs. Frequency**  
Tested under 1Vrms Oscillation Level



**Specification**

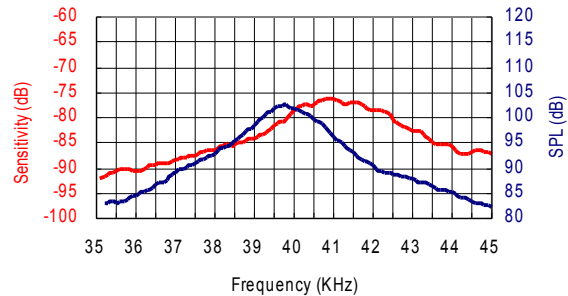
400EP125	Transceiver
Center Frequency	40.0±1.0Khz
Bandwidth (-6dB)	400EP125 1.5Khz
Transmitting Sound Pressure Level (with rubber sleeve)	100dB min.
at resonant frequency;0dB re 0.0002μbar per 10Vrms at 30cm	
Receiving Sensitivity (with rubber sleeve)	-78dB min.
at resonant frequency 0dB = 1 volt/μbar	
Nominal Impedance (Ohm)	1000
Ringing (ms) @25°C	1.2 max.
Capacitance at 1Khz	±20% 1600 pF
Max. Driving Voltage	100Vpp
20 bursts, 25ms repetition rate	
Total Beam Angle	-6dB 108°
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
Models of less ringing are available

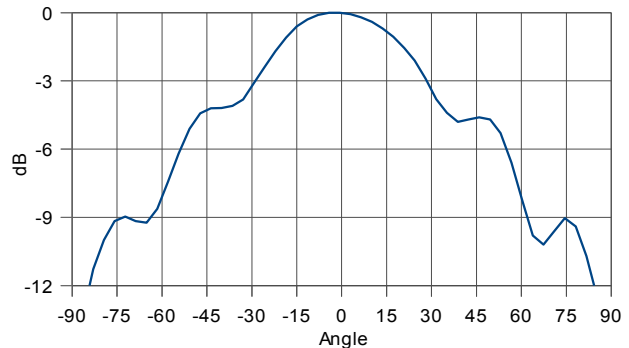
Models available:

1	400EP125	Natural Aluminum Housing
2	400EP125B	Black Painted Housing
3	400EP125BR	Black Housing+Rubber Sleeve

**Sensitivity/Sound Pressure Level**  
SPL Tested under 10Vrms@30cm



**Beam Angle:** Tested at 40.0Khz frequency



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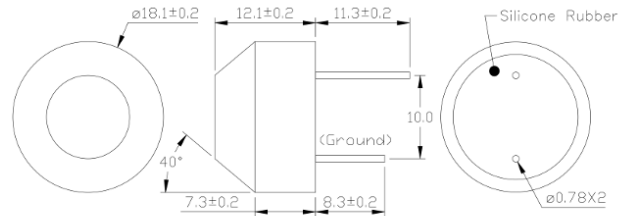
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## Air Ultrasonic Ceramic Transducers

400EP18A

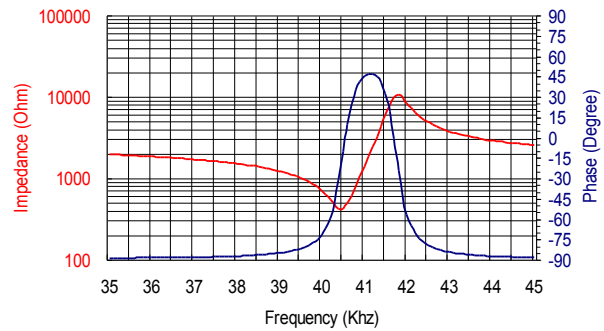


**Dimensions:** dimensions are in mm



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

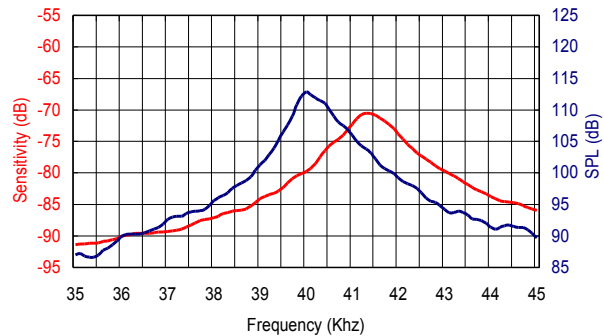


### Specification

400EP18A	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	400EP18A 1.5KHz
Transmitting Sound Pressure Level at resonant frequency; 0dB re 0.0002μbar per 10Vrms at 30cm	108dB min.
Receiving Sensitivity at resonant frequency 0dB = 1 volt/μbar	-75dB min.
Nominal Impedance (Ohm)	750
Ringing (ms)	1.2 max.
Capacitance at 1KHz ±20%	2600 pF
Temperature Compensated Type	5200 pF
Max. Driving Voltage (Cont.)	20Vrms
20 bursts, 25ms repetition rate	100Vpp
Total Beam Angle	-6dB 85°
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm

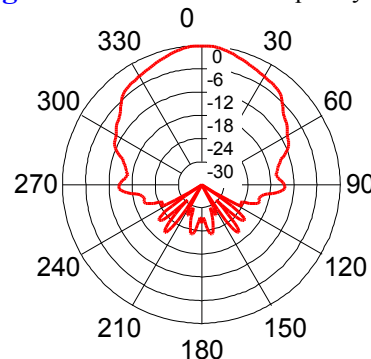


All specification taken typical at 25°C  
Both lead pins and lead wires output are available.  
Temperature compensated type is available upon request.

Models available:

1	400EP18A	Black Al. Housing
2	400EP18A0	Natural Al. Housing
3	400EP18AC	Temp. Compensated

**Beam Angle:** Tested at 40.0KHz frequency



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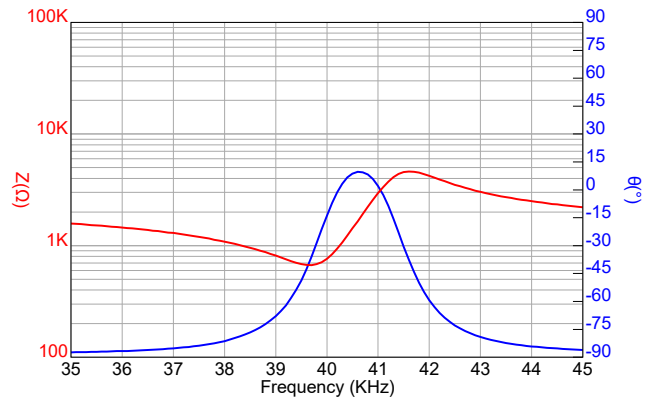
## Air Ultrasonic Ceramic Transducers

400EP250



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



### Specification

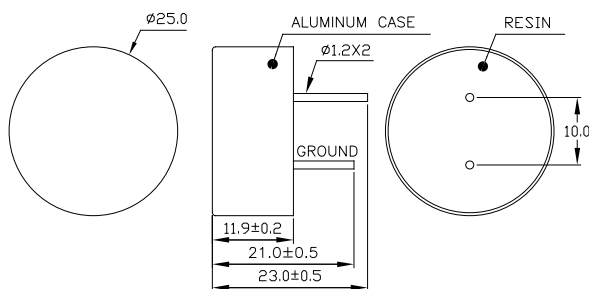
400EP250	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB)	2.0KHz(FOM)
Transmitting Sound Pressure Level at resonant frequency; 0dB re 0.0002μbar per 10Vrms at 30cm	110dB min.
Receiving Sensitivity at resonant frequency 0dB = 1 volt/μbar	-72dB min.
Capacitance at 1KHz ±20%	2700 pF
Max. Driving Voltage at 20 bursts, 25 ms repetition rate	100 Vp-p
Total Beam Angle(-6dB)	30° typical
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C;  
Closer frequency tolerance, shorter ringing, wider bandwidth and temperature compensated models can be supplied upon request.

Model available:

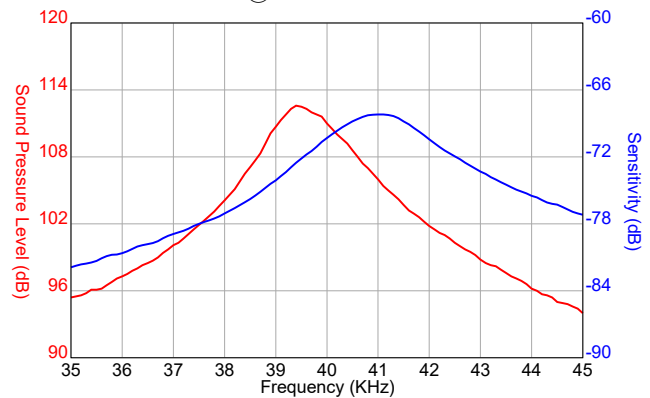
1	400EP250	Aluminum Housing
2	400EP25B	Black Al. Housing

**Dimensions:** dimensions are in mm

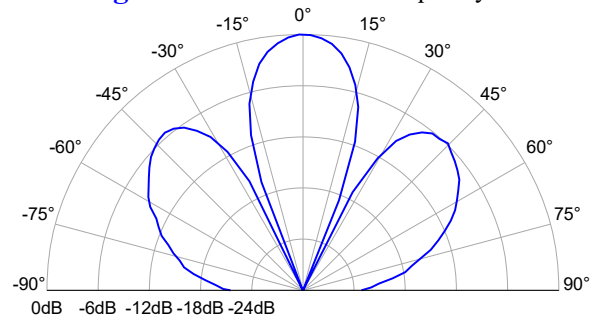


### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle: Tested at 40.0KHz Frequency

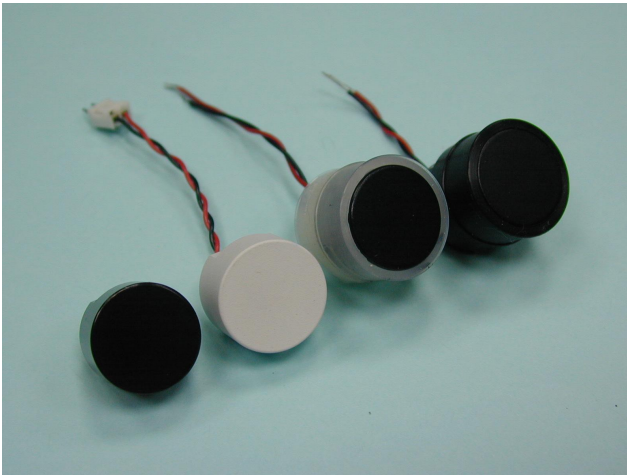


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## Air Ultrasonic Ceramic Transducers

400EP14D



### Asymmetric Beam Patterns Specification

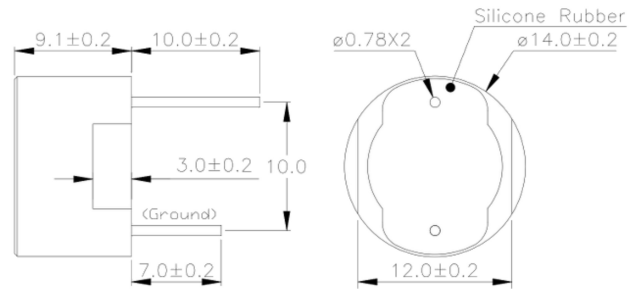
400EP14D	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB FOM)	1.0KHz
Transmitting Sound Pressure Level at resonant frequency;0dB re 0.0002μbar per 10Vrms at 30cm	103dB min. (Transducer alone)
Receiving Sensitivity at resonant frequency 0dB = 1 volt/μbar	-78dB min. (Transducer alone)
Nominal Impedance (Ohm)	1000
Ringling (ms)	1.2 max.
Capacitance at 1KHz ±20%	1600 pF
Temperature Compensated Type	3200 pF
Max. Driving Voltage (cont.)	20Vrms
20 bursts, 25ms repetition rate	100Vpp
Total Beam Angle -6dB	Wide 135° typ. Narrow 85° typ.
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
Both lead pins and lead wires output are available

Models available:

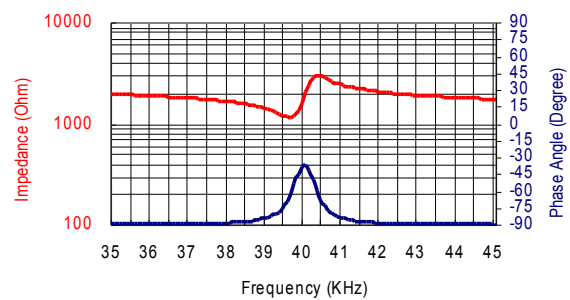
1	400EP14D	Black Painted Housing
2	400EP14DC	Temperature compensated (TC)
3	400EP14DCR	T.C. + Rubber Sleeve

**Dimensions:** dimensions are in mm



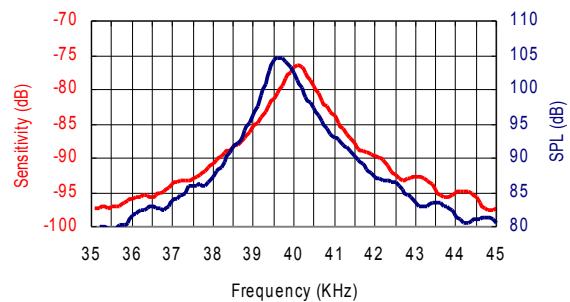
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



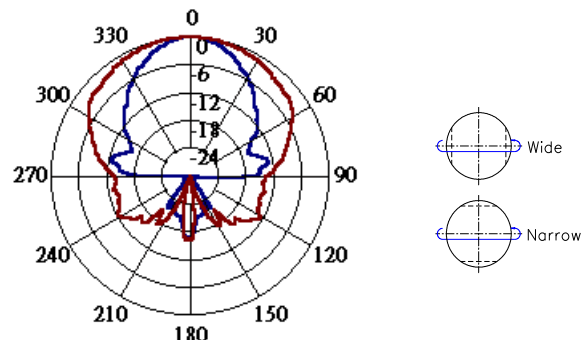
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



### Beam Angle: Tested at 40.0Khz frequency

Wide Angle \_\_\_\_\_ Narrow Angle \_\_\_\_\_



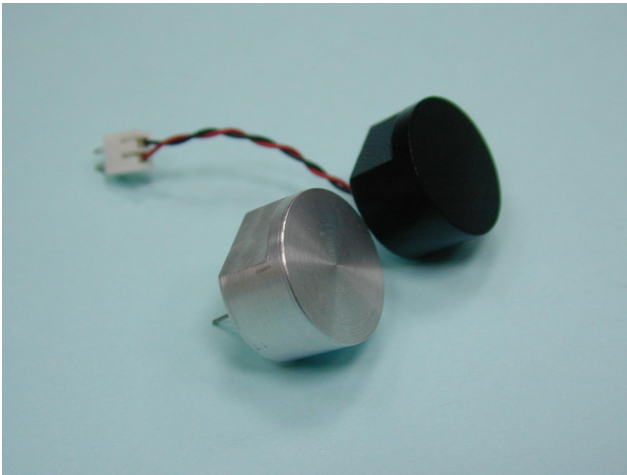
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## Air Ultrasonic Ceramic Transducers

400EP18D



### Asymmetric Beam Patterns Specification

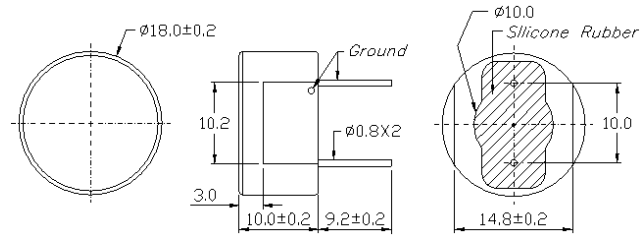
400EP18D	Transceiver
Center Frequency	40.0±1.0KHz
Bandwidth (-6dB) F.O.M.	2.0KHz
Transmitting Sound Pressure Level at resonant frequency; 0dB re 0.0002μbar per 10Vrms at 30cm	100dB min.
Receiving Sensitivity at resonant frequency 0dB = 1 volt/μbar	-80dB min.
Nominal Impedance (Ohm)	1000
Ringing	1.2ms max.
Capacitance at 1KHz ±20%	1800 pF
Temperature Compensated Type	3600 pF
Max. Driving Voltage (Cont.)	20Vrms
20 bursts, 25ms repetition rate	100Vpp
Total Beam Angle -6dB	Wide* 135° typ. Narrow* 75° typ.
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

All specification taken typical at 25°C  
Both lead pins and lead wires output are available

Models available:

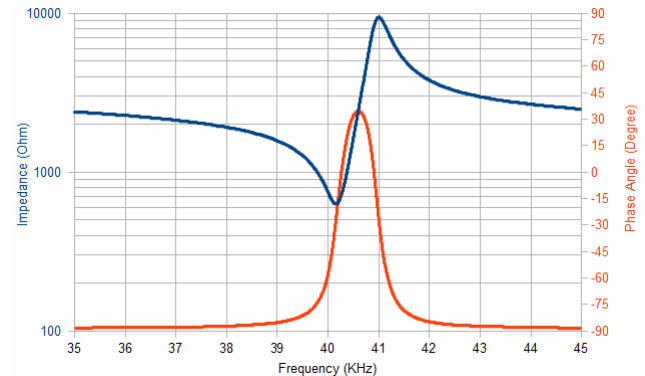
1	400EP18D	Black Al. Housing
2	400EP18DC	Temp. Compensated
3	400EP18DCR	T.C. with Rubber Sleeve

**Dimensions:** dimensions are in mm



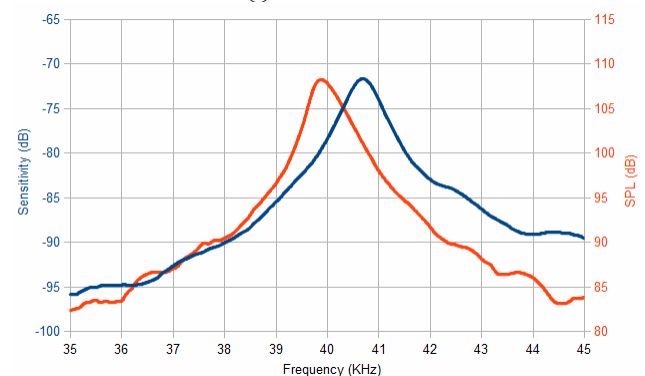
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



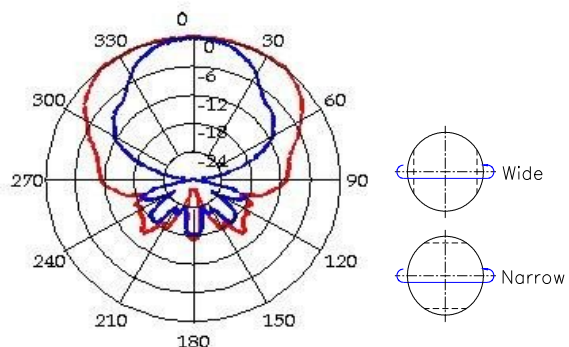
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



**Beam Angle:** Tested at 40.0Khz frequency

Wide Angle \_\_\_\_\_ Narrow Angle \_\_\_\_\_



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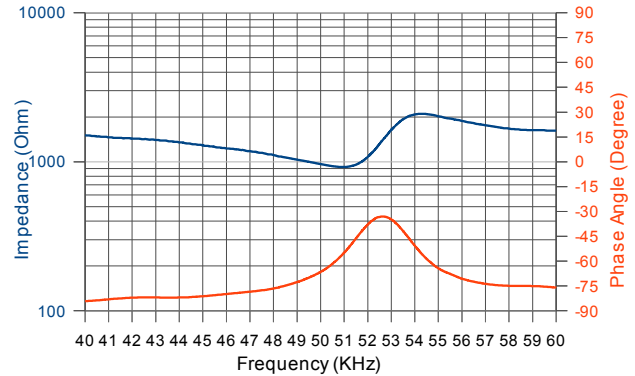
## Air Ultrasonic Ceramic Transducers

480EP900



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



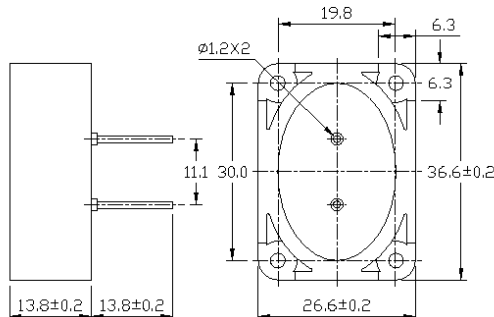
### Asymmetric Beam Patterns

#### Specification

480EP900	Transceiver
Center Frequency	48.0±1.0KHz
Bandwidth (97dB) Transmitter	15.0KHz
(-80dB) Receiver	15.0KHz
Transmitting Sound Pressure Level at 48KHz; 0dB re 0.0002µbar per 10Vrms at 30cm	100dB min.
Receiving Sensitivity at 48KHz; 0dB = 1 volt/µbar	-80dB min.
Nominal Impedance (Ohm)	1000
Ringing (ms)	1.2 max.
Capacitance at 1KHz ±20%	2400 pF
Max. Driving Voltage @20 bursts, 25 ms repetition rate	100 Vp-p
Total Beam Angle -6dB @ 48KHz	Long Axis 19° typ. Short Axis 38° typ.
Operation Temperature	-30 to 70°C
Storage Temperature	-40 to 80°C

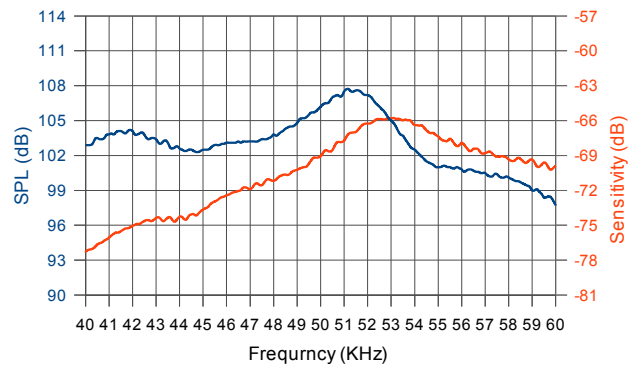
All specification taken typical at 25°C  
Closer frequency tolerance, shorter ringing and wider bandwidth models can be supplied upon request.

**Dimensions:** dimensions are in mm



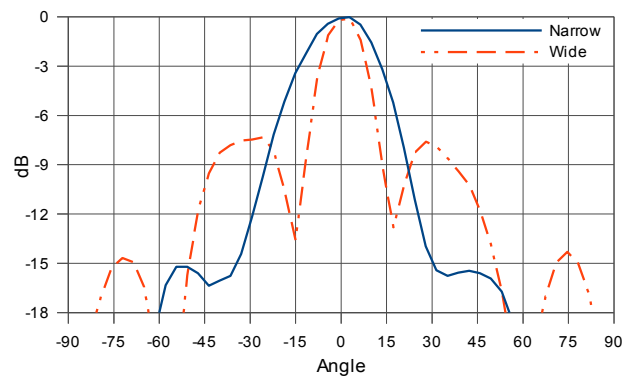
### Sensitivity/Sound Pressure Level

Tested under 10Vrms @30cm



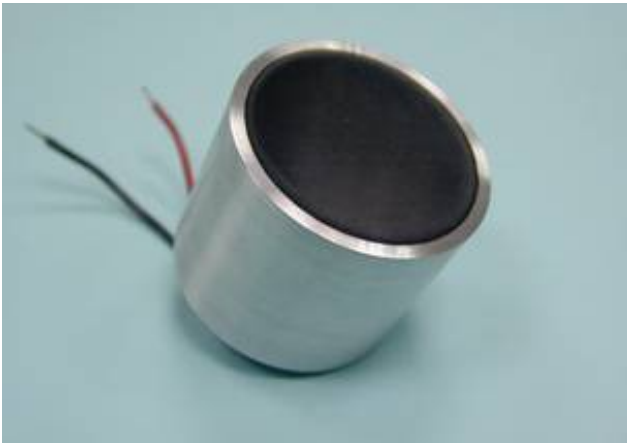
### Beam Angle

Tested at 48.0KHz



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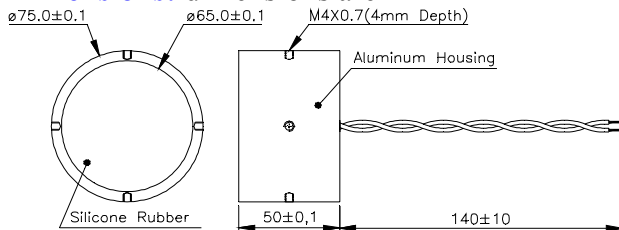


### Specification

043SR750	Transceiver
Center Frequency	43.0±4.0 KHz
Bandwidth (Echo Sensitivity)	2 KHz
Echo Sensitivity	-55 dB min.
0dB re 20Vp-p, 40 bursts @ 100cm	
Nominal Impedance	700 Ω
Capacitance at 1KHz	5700 pF ±20%
Max. Driving Voltage (Pulse)	1500 Vpp 2% duty cycle tone burst
Total Beam Angle	-3dB 7.5° typical -6dB 11.0° typical
Matching Window	Silicone Rubber
Operation Temperature	-20 to 70°C
Storage Temperature	-30 to 80°C

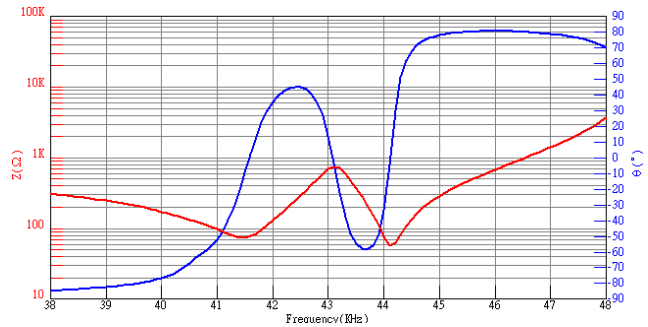
All specification taken typical at 25°C  
Low ringing model can be arranged

### Dimensions: dimensions are in mm



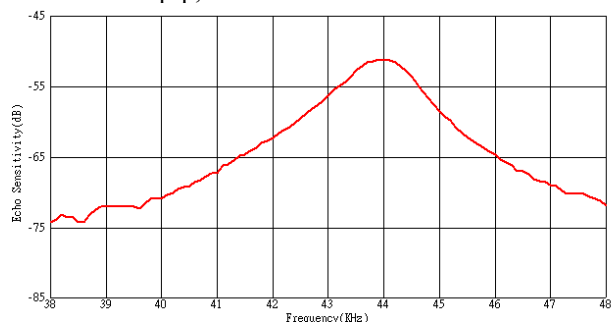
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



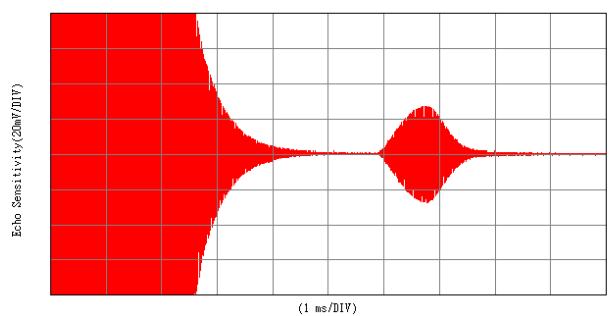
### Echo Sensitivity vs. Frequency

Tested at 20Vp-p, 40 bursts

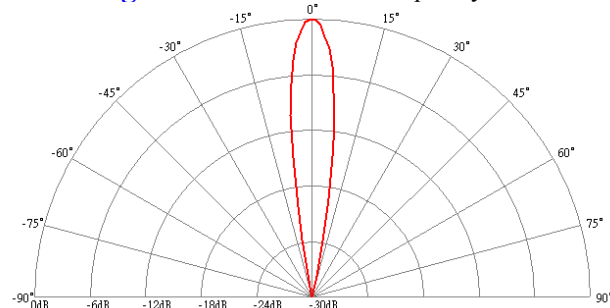


### Echo Sensitivity/Ringing

Tested under 20Vp-p, 40 bursts, 100cm



### Beam Angle: Tested at 43.0KHz frequency



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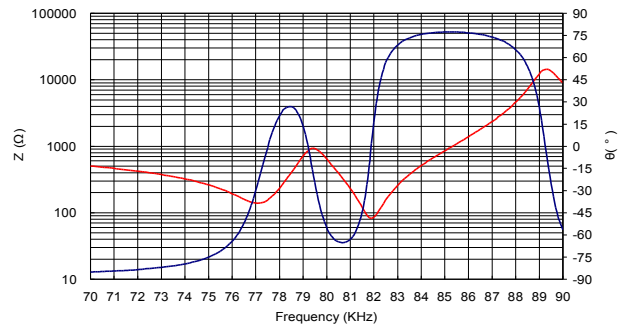
## Air Ultrasonic Ceramic Transducers

080SR365



### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level

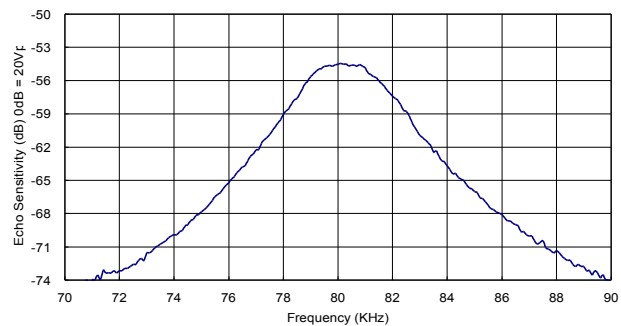


### Specification

080SR365	Transceiver
Center Frequency (KHz)	80.0±5.0
Echo Sensitivity 0dB = 20Vp-p @ 50 cm	-57 dB min.
Dead Zone	35 cm
Bandwidth (Echo Sensitivity)	4.5 KHz
Nominal Impedance (Ohm)	700
Capacitance at 1KHz ±20%	2800 pF
Max. Driving Voltage (Pulse)	700Vpp 2% duty cycle
Total Beam Angle	-3dB 8.0° typical -6dB 11.0° typical
Matching Window	Silicone Rubber
Operation Temperature	-20 to 70°C
Storage Temperature	-30 to 80°C

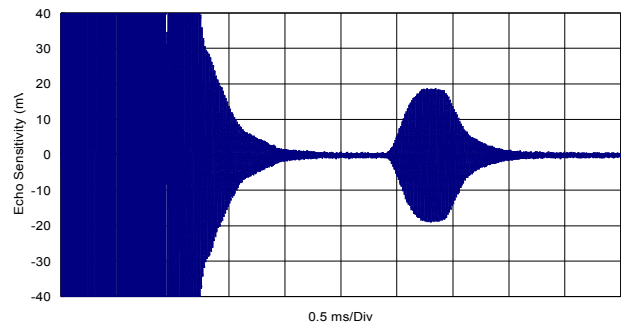
### Echo Sensitivity vs. Frequency

Tested at distance of 50cm, 20Vp-p, 40 bursts



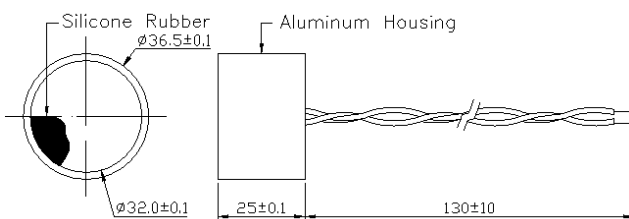
### Echo Sensitivity/Ringing

Tested under 20Vp-p, 40 bursts, 50cm

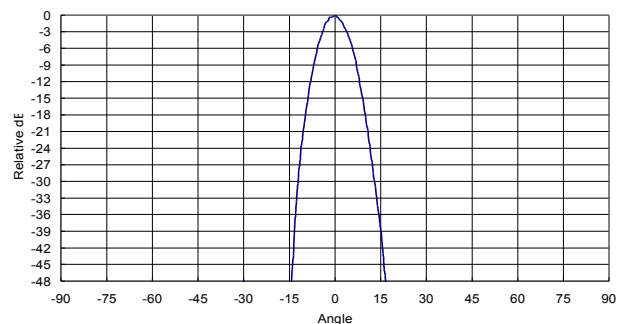


All specification taken typical at 25°C  
Low ringing model can be arranged

### Dimensions: dimensions are in mm



### Beam Angle: Tested at 80 KHz frequency

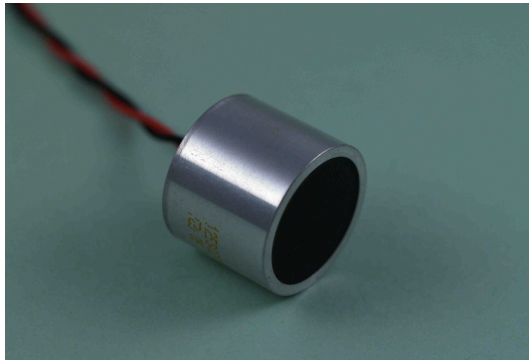


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## Air Ultrasonic Ceramic Transducers

125SR250

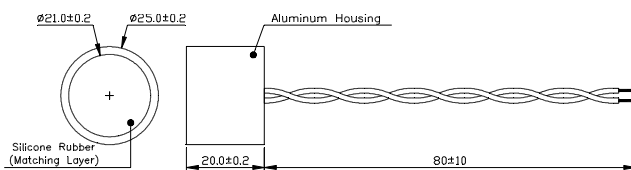


### Specification

125SR250	Transceiver
Center Frequency (KHz)	125.0±10.0
Echo Sensitivity 0dB = 20Vp-p @ 25 cm (40 bursts)	-55 dB min.
Dead Zone (10burst)	20 cm
Bandwidth (Echo Sensitivity)	8 KHz
Nominal Impedance (Ohm)	200
Capacitance at 1KHz ±20%	1250 pF
Max. Driving Voltage (Pulse) 2% duty cycle tone burst	200Vpp
Total Beam Angle -3dB	8.0° typical
-6dB	11.0° typical
Matching Window	Silicone Rubber
Operation Temperature	-20 to 60° C
Storage Temperature	-30 to 70° C

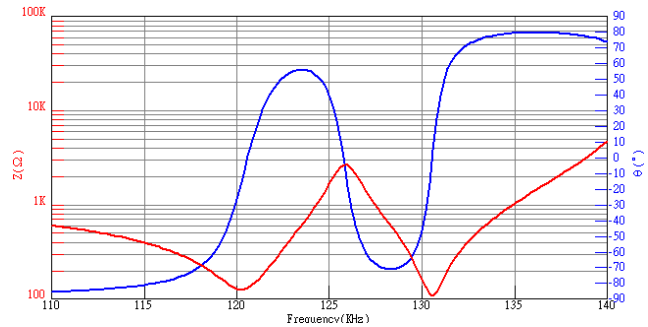
All specification taken typical at 25°C  
Low ringing model can be arranged

**Dimensions:** dimensions are in mm



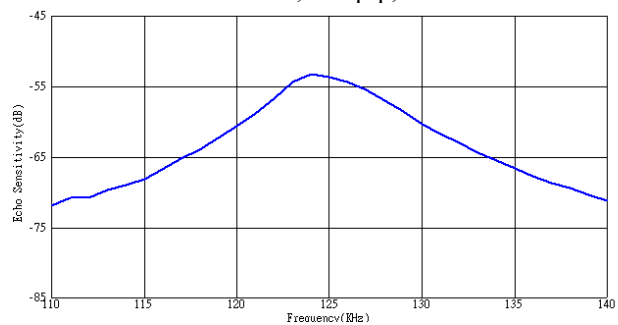
### Impedance/Phase Angle vs. Frequency

Tested under 1Vrms Oscillation Level



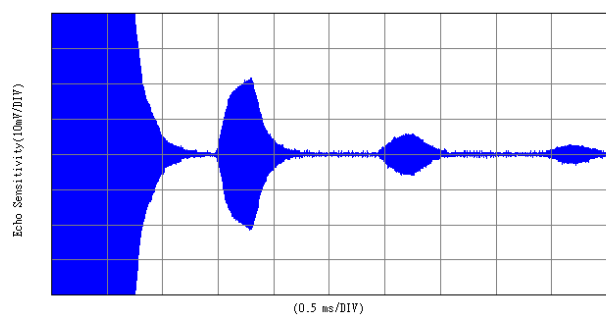
### Echo Sensitivity vs. Frequency

Tested at distance of 25cm, 20Vp-p, 40 bursts

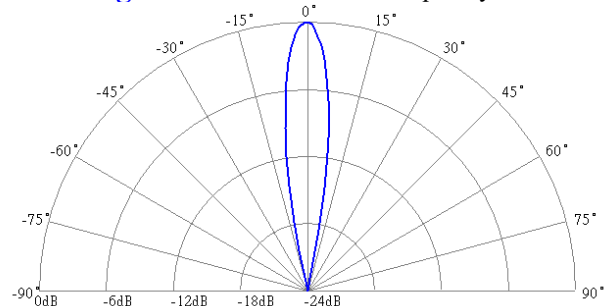


### Echo Sensitivity/Ringing

Tested under 20Vp-p, 40 bursts, 25cm



### Beam Angle: Tested at 125.0KHz frequency

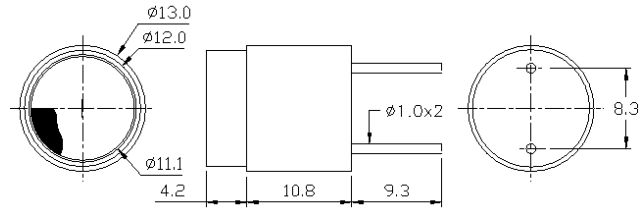


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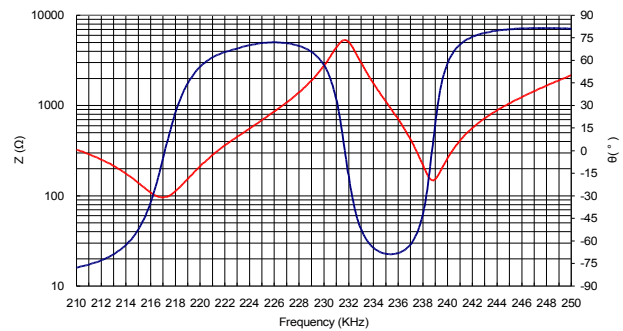


**Dimensions:** dimensions are in mm



**Impedance/Phase Angle vs. Frequency**

Tested under 1Vrms Oscillation Level



**Specification**

235SR130	Transceiver
Center Frequency (KHz)	235.0±10.0
Overall Echo Sensitivity 0dB = 20Vp-p @ 25 cm	-61 dB min. (40 bursts)
Bandwidth (Echo Sensitivity)	10KHz
Capacitance at 1KHz ±20%	540 pF
Max. Driving Voltage (Pulse)	80Vpp 10% duty cycle tone burst
Total Beam Angle	-3dB 7.0° typical
	-6dB 10.0° typical
Matching Window	Silicone Rubber
Operation Temperature	-20 to 60°C
Storage Temperature	-30 to 70°C

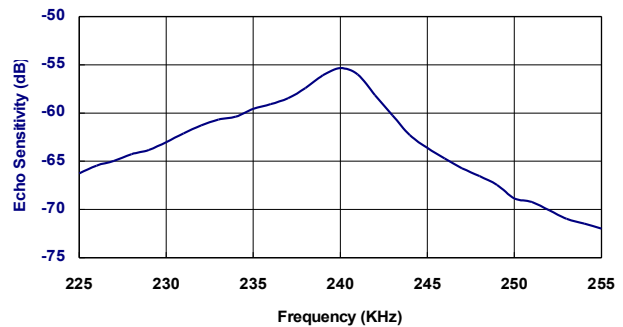
All specification taken typical at 25°C  
Closer frequency tolerance, shorter ringing and wider bandwidth models can be supplied upon request.

**Model available:**

1	235SR013	Aluminum Housing
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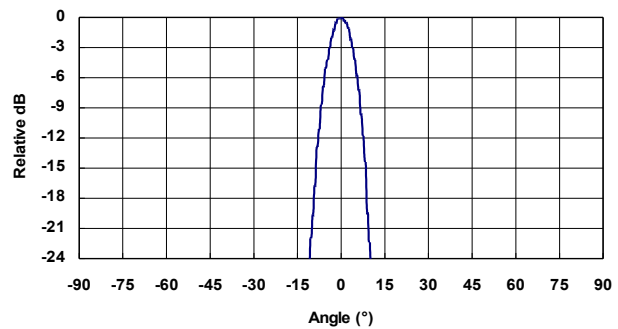
**Echo Sensitivity**

Tested under 20Vp-p @25cm; 0dB=20Vp-p



**Beam Angle:** Tested at 235.0Khz frequency

Reflector: Aluminum Plate L75×W75×T10 (mm)

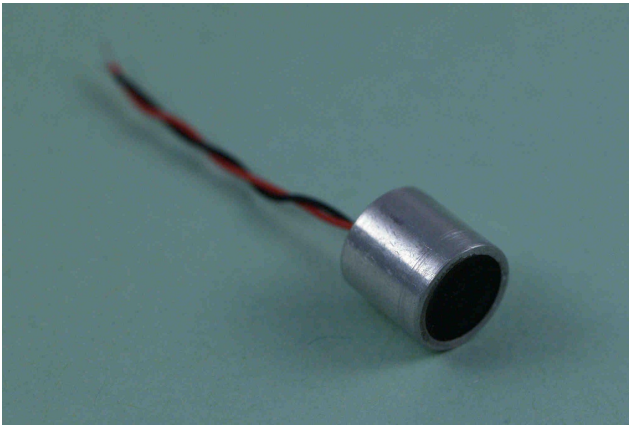


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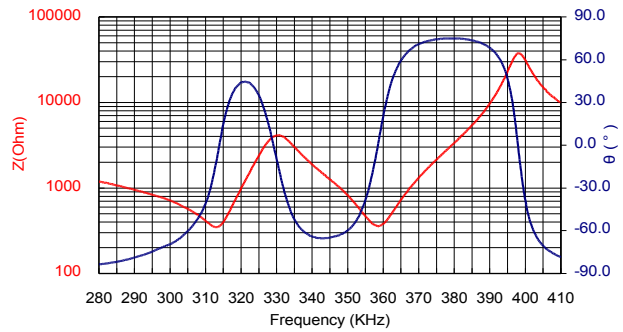
**Air Ultrasonic Ceramic Transducers**

**320SR093**



**Impedance/Phase Angle vs. Frequency**

Tested under 1Vrms Oscillation Level

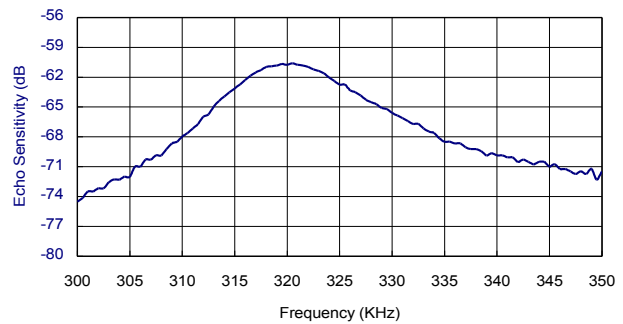


**Specification**

320SR093	Transceiver
Center Frequency (KHz)	320.0±10.0
Echo Sensitivity 0dB = 20Vp-p, 50 Bursts @ 10 cm	-65 dB min.
Dead Zone	8 cm
Bandwidth (Echo Sensitivity)	10KHz
Nominal Impedance (Ohm)	1200
Capacitance at 1Khz ±20%	270 pF
Max. Driving Voltage (Pulse)	50Vpp 10% duty cycle
Total Beam Angle	-3dB 9.5° typical -6dB 12.5° typical
Matching Window	Silicone Rubber
Operation Temperature	0 to 70°C
Storage Temperature	-20 to 80°C

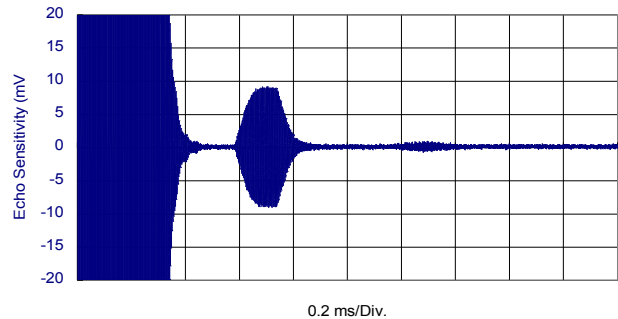
**Echo Sensitivity vs. Frequency**

Tested at distance of 10cm, 20Vp-p, 50 bursts



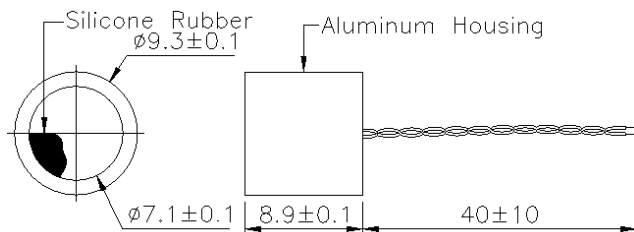
**Echo Sensitivity/Ringing**

Tested under 20Vp-p, 50 bursts, 10cm

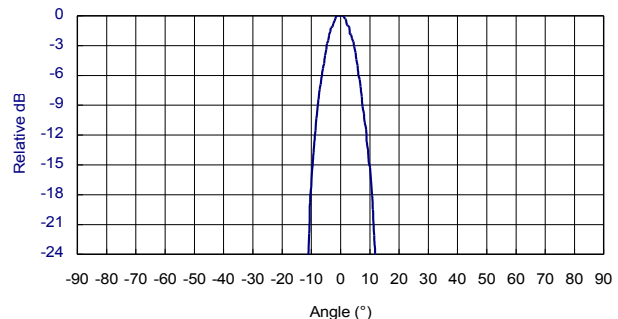


All specification taken typical at 25°C  
Low ringing model can be arranged

**Dimensions:** dimensions are in mm



**Beam Angle:** Tested at 314.0 KHz frequency



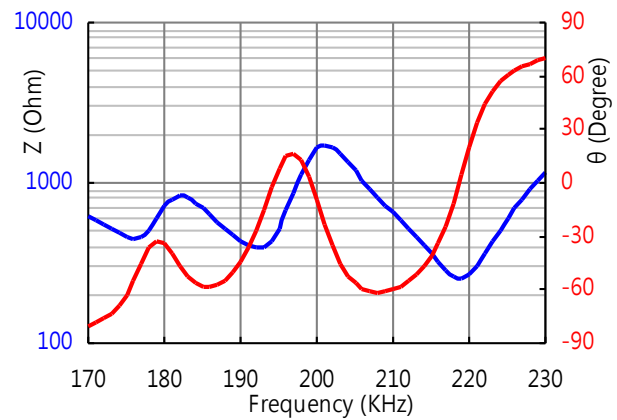
**S. Square Enterprise Company Limited**  
**Pro-Wave Electronics Corporation**

[Http://www.pro-wave.com.tw](http://www.pro-wave.com.tw) ; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw) ; Tel: 886-2-22465101 ; Fax: 886-2-22465105



### Impedance/Phase Angle vs. Frequency:

Tested under 1Vrms Oscillation Level



### Specification

200GE180	Transceiver
Center Frequency	200.0±10KHz
Echo Sensitivity	-61dB
0dB = 20Vp-p , 30 Bursts Square wave	
Bandwidth (FOM)	10KHz
Nominal Impedance (Ohm)	600
Capacitance at 1Khz ±20%	600 pF
Max. Driving Voltage (Pulse)	50Vpp 10% duty cycle
Total Beam Angle	-6dB 10° typical
Matching Window	Resin with filler
Operation Temperature	-20 to 60°C
Storage Temperature	-30 to 70°C

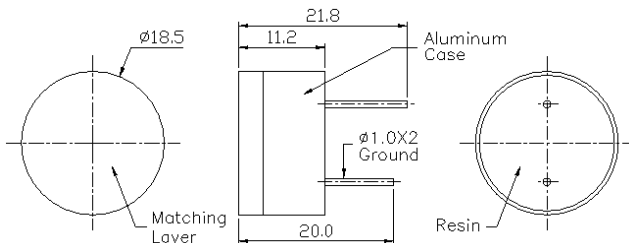
All specification taken typical at 25°C

Closer frequency tolerance, shorter ringing and wider bandwidth models can be supplied upon request.

### Model available:

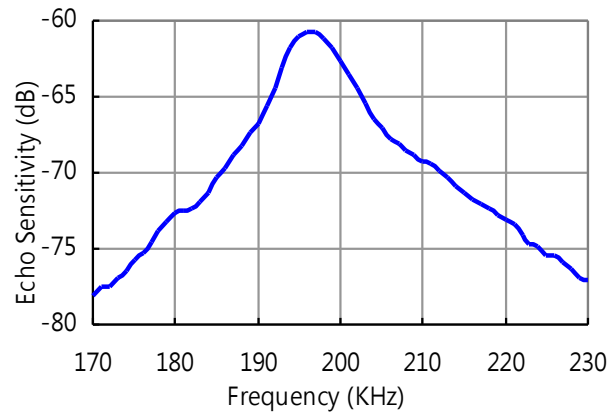
1	200GE180	Aluminum Housing
---	----------	------------------

**Dimensions:** dimensions are in mm

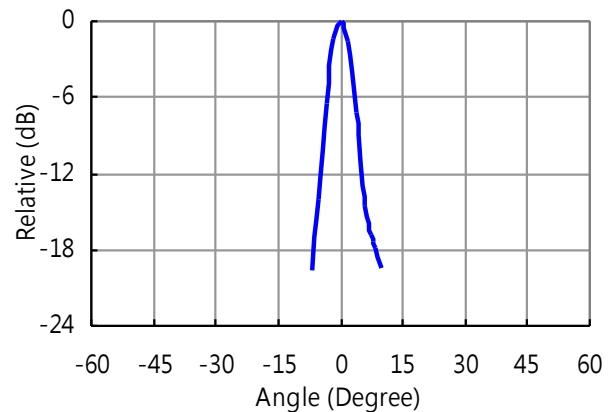


### Echo Sensitivity:

Tested under 20Vp-p @25cm ; 0dB=20Vp-p



### Beam Angle: Tested at 200.0Khz frequency



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### Ultrasonic Transducer Assembled Units

Transducers equip with a 2.5 meters shield cable and covered by a rubber boot with a metal clip for easy installation are very suitable for most of vehicle alarms.

RCA, Amp or Molex type connector at the other cable end is available upon request.

### Specification

Model Number	SQS-04	SQS-05	SQS-06
Transducer used	400ST/R100 or 10P	400ST/R120	400ST/R160 or 16P
Cable length	2.5 meters		
Connector used	RCA/Amp/Molex type or others upon request		

### Dimensions

SQS-04	SQS-05	SQS-06

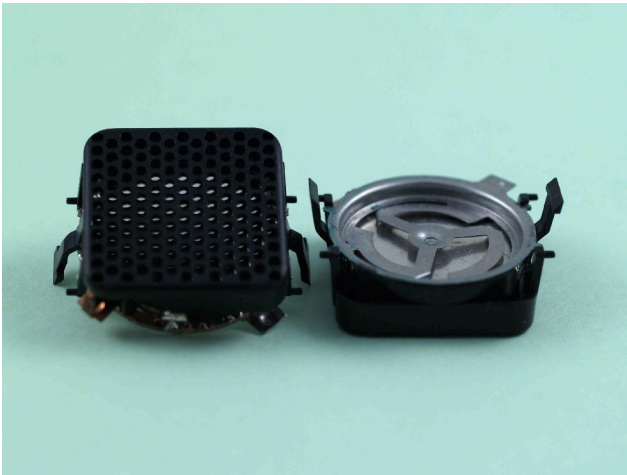


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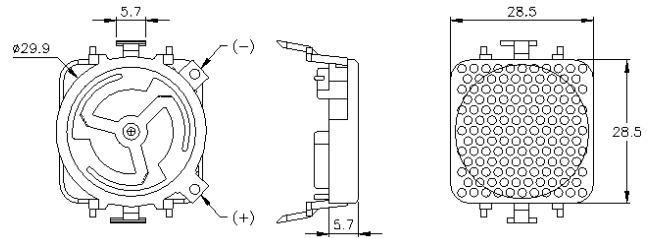
[Http://www.pro-wave.com.tw](http://www.pro-wave.com.tw) ; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw) ; Tel: 886-2-22465101 ; Fax: 886-2-22465105

**Electrostatic Ultrasonic Transducers**

**500ES290**

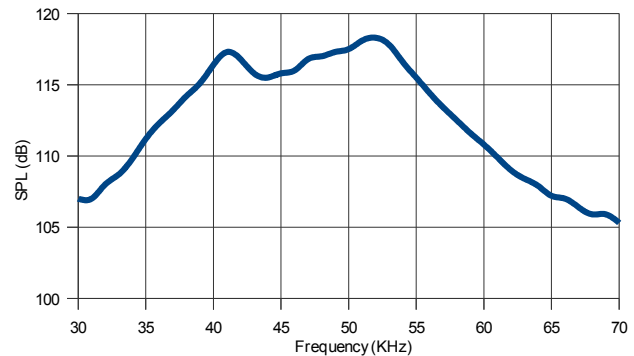


**Dimensions:** dimensions are in mm

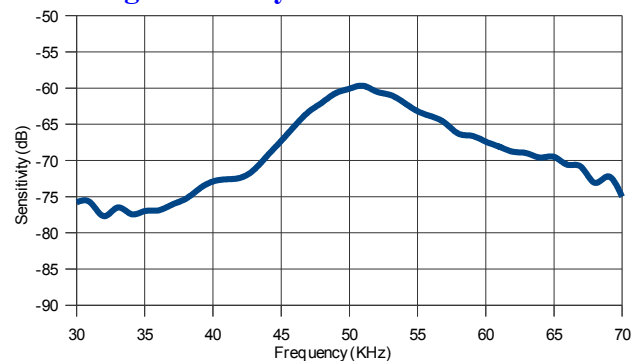


**Transmitting Sound Pressure Level**

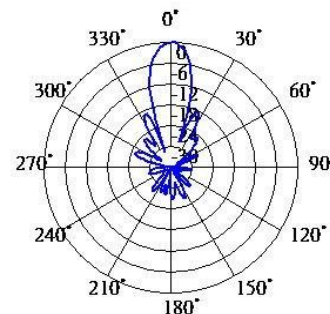
Tested under 300Vac pk-pk, 200Vdc bias @50 cm



**Receiving Sensitivity:** Tested under 200Vdc bias



**Beam Angle:** Tested at 50.0Khz frequency



**Specification**

500ES290	Transceiver
Center Frequency	50.0±1.0KHz
Transmitting Sound Pressure Level at 50.0KHz; 0dB re 20µPa per 300Vac pk-pk, 200Vdc bias at 50 cm	116.0 dB min.
Receiving Sensitivity at 50.0KHz, 200Vdc bias, 0dB = 1 volt/µbar (0dB = 1 volt/Pa)	-65.0 dB (-45.0 dB)
Capacitance at 1KHz ±20%	600 - 700 pF
Suggested DC Bias Voltage	200 V
Suggested AC Driving Voltage	300V pk-pk
Maximum Combined Voltage	400V
Total Beam Angle	-6dB 13° typical
Operation Temperature	0 to 60°C
Standard Finish	
Foil (Diaphragm):	
1. 500ES290-G	Gold
2. 500ES290-A	Aluminum
Housing	ABS

All specification taken typical at 25°C



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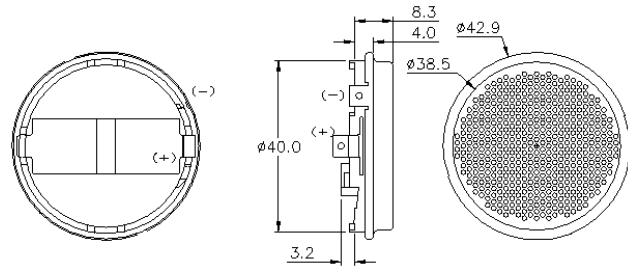
[Http://www.pro-wave.com.tw](http://www.pro-wave.com.tw) ; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw) ; Tel: 886-2-22465101 ; Fax: 886-2-22465105

**Electrostatic Ultrasonic Transducers**

**500ES430**

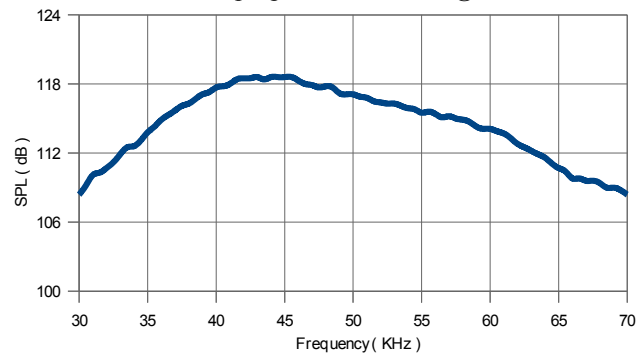


**Dimensions:** dimensions are in mm



**Transmitting Sound Pressure Level**

Tested under 300Vac pk-pk, 200Vdc bias @50 cm



**Specification**

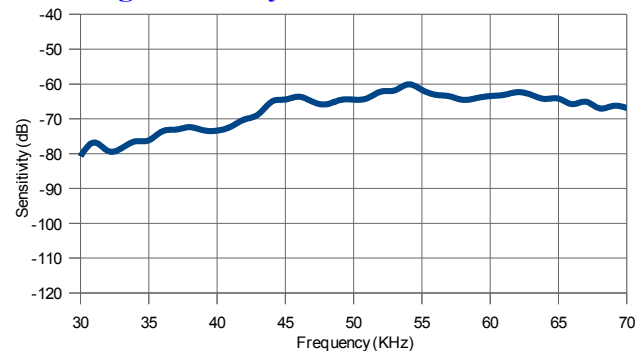
500ES430	Transceiver
Center Frequency	50.0±1.0KHz
Transmitting Sound Pressure Level at 50.0KHz; 0dB re 20µPa per 300Vac pk-pk, 200Vdc bias at 50 cm	116 dB min.
Receiving Sensitivity at 50.0KHz, 200Vdc bias, 0dB = 1 volt/Pa (0dB =1 volt/µbar)	-43 dB min. (-63 dB) min.
Capacitance at 1KHz ±20%	400 - 500 pF
Suggested DC Bias Voltage	200 V
Suggested AC Driving Voltage	300V pk-pk
Maximum Combined Voltage	400V
Total Beam Angle	-6dB 13° typical
Operation Temperature	0 to 60°C
Standard Finish	
Foil (Diaphragm)	See below
Housing	See below

All specification taken typical at 25°C

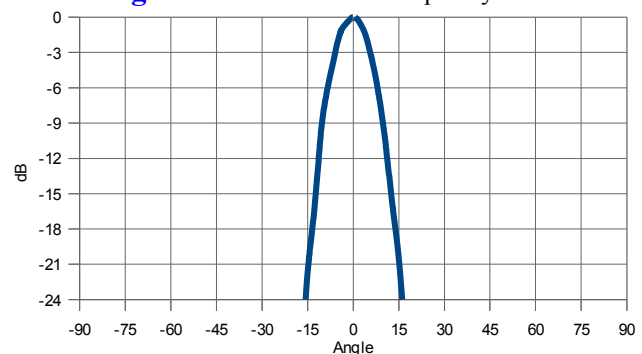
**Models available**

Model	Foil	Housing
500ES43AB	Aluminum	Black Painted Steel
500ES43AS	Aluminum	SUS 304
500ES43GB	Gold	Black Painted Steel
500ES43GS	Gold	SUS 304

**Receiving Sensitivity:** Tested under 200Vdc bias



**Beam Angle:** Tested at 50.0Khz frequency



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## Bolt Clamped High Power Transducers



### Features

- High efficiency & high output
- Large amplitude
- Low heat generation
- Durability & stability
- Easy connection

### Applications

- Ultrasonic cleaners
- Ultrasonic welders
- Ultrasonic processing machines: bonding, drilling, etching, engraving and etc.

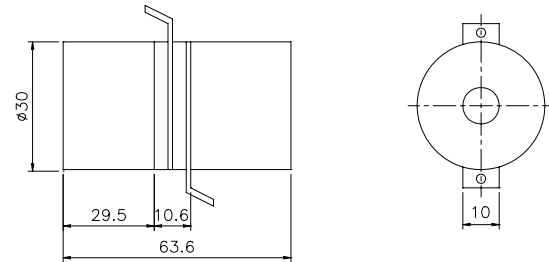
### Specification

	30402S	45402H	45282H	60282H
Resonant frequency (KHz)	37.5	40.0	28.2	28
Motion Admittance (mMho)	35	15	50	40
Mechanic Q (Qm)	500	500	500	500
Capacitance (pF)	2700	4000	4000	4000
Allowable vibration rate (cm/sec.)	50	50	50	25

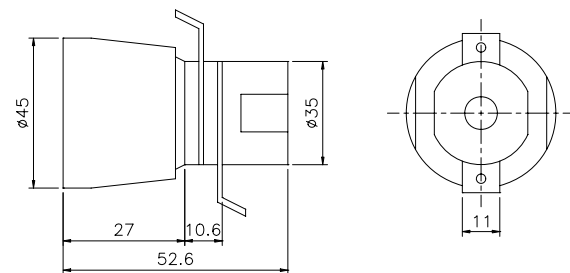
All specification taken typical at 25°C

### Dimensions

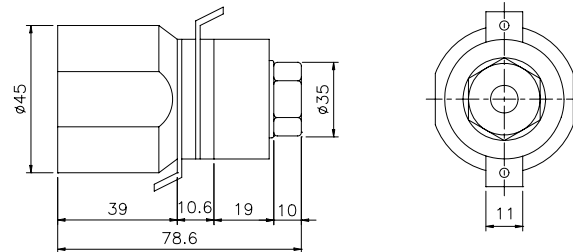
#### Model: 30402S



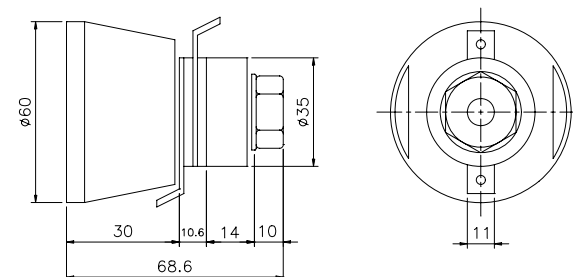
#### Model: 45402H



#### Model: 45282H

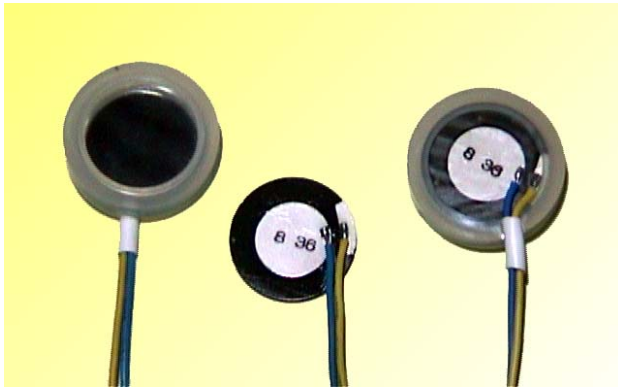


#### Model: 60282H



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## Ultrasonic Atomizing Transducers



The ultrasonic atomizing transducers using our factory made high Q hard type piezoelectric ceramic element is ideal for atomizing liquids. A very fine mist having a particle diameter of only a few microns can be generated. We are not only supply atomizing element but also entire assembled transducer unit with silicone rubber holder.

### Features

- Piezoelectric ceramic element clad with stainless steel for erosion resistance.
- Fine and consistent particle size of less than  $3\mu\text{m}$
- High atomizing efficiency  $>400$  cc/hour
- Less power consumption
- High stability and durability

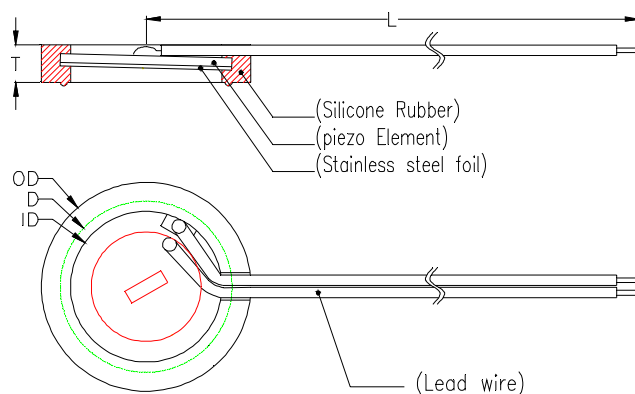
### Applications

- Humidification in refrigerated food displays and storage, living environments, and air conditioning plants.
- Inhalation and disinfecting equipment
- Humidification in industrial process control for lubrication, coating and etc.

### Specification:

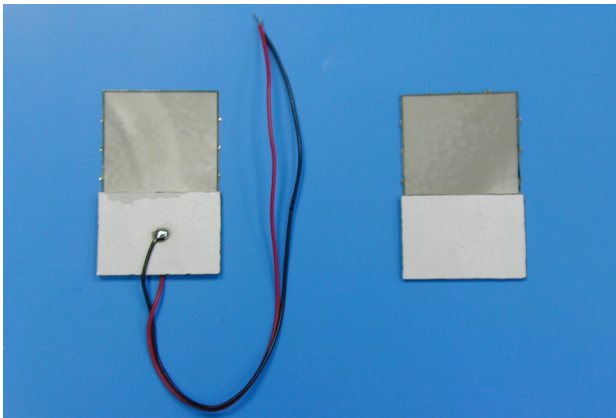
Model Number	M165D20	M165D25
Resonance Frequency (MHz)	$1.65\pm 0.05$	$1.65\pm 0.05$
Resonance Impedance (Ohm)	$<2.0$	$<2.0$
Capacitance at 1KHz (pF)	$2,000 \pm 20\%$	$2,000 \pm 20\%$
Dissipation Factor at 1KHz	$<0.5\%$	$<0.5\%$
Operation Duration (hour)	$>5,000$	$>5,000$
Atomizing Quantity (cc/Hour)	300	400
Input Power (maximum)	25	30
Operation Temperature	0 to $45^{\circ}\text{C}$	0 to $45^{\circ}\text{C}$
Dimensions	L	110
	T	5
	OD	25
	ID	17.4

### Dimensions dimensions are in mm



Ultrasonic Vibration Micro Nozzle

M2313500



The ultrasonic vibration micro nozzle consists a piezoelectric ceramic and a metal foil, on which over thousands micro nozzles formed. Using the same principle as inkjet printer, this transducer atomizes water or liquids through a matrix of micro holes of around 7-10  $\mu\text{m}$ .

The micro nozzles ultrasonic atomizing transducer can use siphon to draw small amount liquids to the surface of metal foil and then to atomize, which is much efficiency than the conventional ultrasonic atomizer for which a liquid tank with high level liquid has to be always loaded on the surface of ultrasonic transducers.

Features

- Fine and consistent misted particle size
- Adjustable misted particle size
- No loaded liquids require as comparing with conventional atomizers
- High atomizing efficiency
- Less power consumption
- High stability and durability

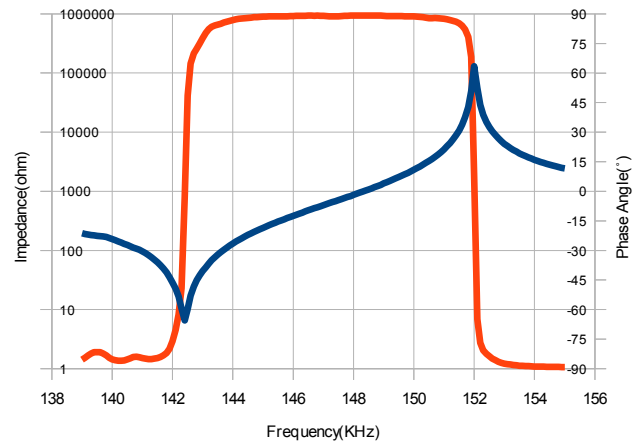
Applications

- Humidification in refrigerated food displays and storage, living environments, and air conditioning plants.
- Inhalation and disinfecting equipment
- Humidification in industrial process control for lubrication, coating and etc.
- Liquids dispensing systems

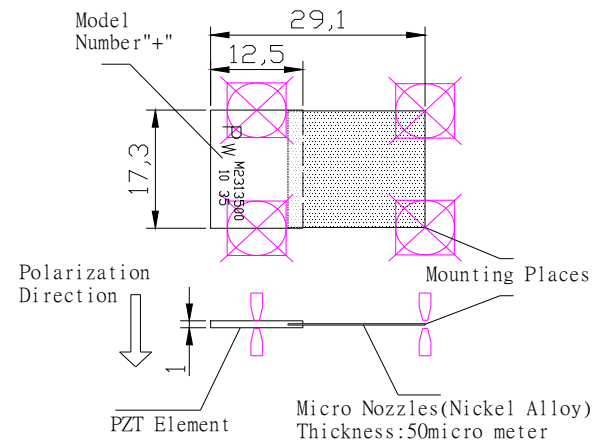
Specification:

Resonant Frequency	143 $\pm$ 5	KHz	
Impedance	10	ohm	typ
Capacitance	2300 $\pm$ 20%	pF	@1KHz , 20°C
Dimensions	L	29.1 $\pm$ 0.2	mm
	W	17.3 $\pm$ 0.1	mm
	T	1.0 $\pm$ 0.1	mm
Metal Material	50	$\mu\text{m}$	PZT Element
Nozzle size	7 $\pm$ 3	$\mu\text{m}$	Ni-Co Alloy

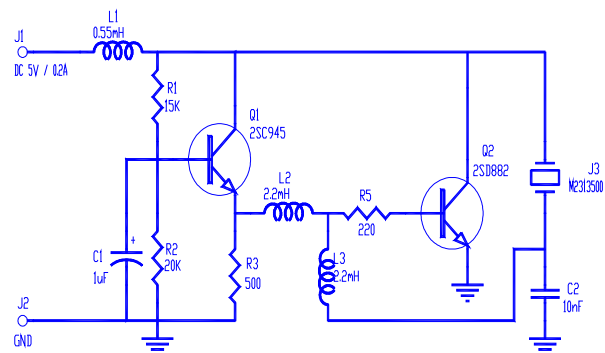
Impedance/Phase Angle:



Construction



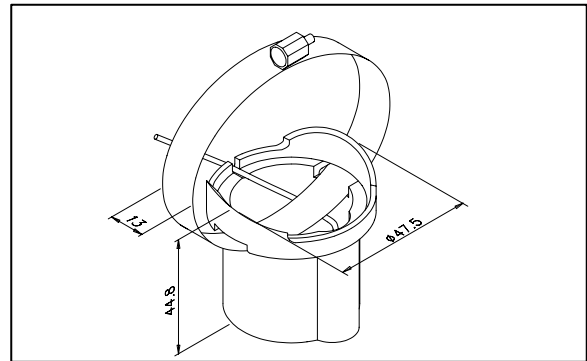
Driving Circuit



Remark: The negative side faces to the opening, the positive side faces to the liquid source, if driving circuit uses NPN transistor.



**Dimensions:** dimensions are in mm



**Specification**

<b>200LM450</b>	Transceiver
<b>Center Frequency</b>	200±10.0Khz
<b>Bandwidth (FOM -6dB)</b>	25Khz
<b>Transmitting Sound Pressure Level</b>	160dB min.
0dB re 1µPa per 1Vrms at 100cm	
<b>Receiving Sensitivity</b>	-180dB min.
0dB = 1 volt/µPa	
<b>Submerged Impedance (Ohm)</b>	200
<b>Capacitance at 1Khz ±20%</b>	2000 pF
<b>Input Power (Pulse Drive)</b>	50 Watts
<b>Total Beam Angle -6dB</b>	20°
<b>Cable Length</b>	4.5 m
<b>Molded Connector</b>	RCA Phono plug 90°
<b>Housing Material</b>	Plastic resin

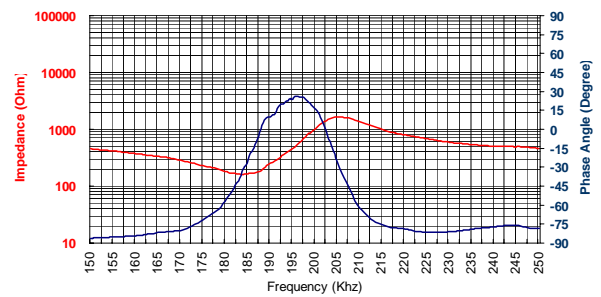
Closer frequency tolerance, shorter ringing and wider bandwidth models can be supplied upon request.

Model available:

1	200LM450	Plastic Housing
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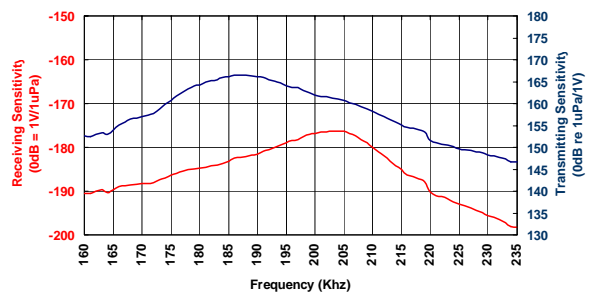
**Submerged Impedance/Phase Angle vs. Frequency**

Tested under 1Vrms Oscillation Level



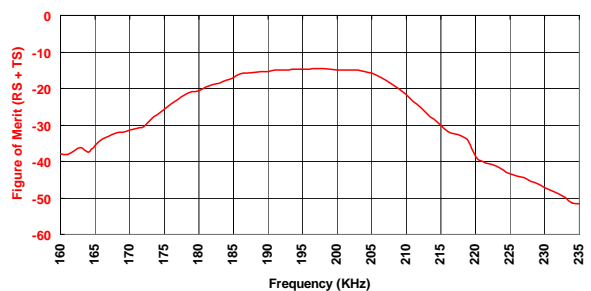
**Receiving /Transmitting Sensitivity**

Tested at distance of 100cm



**Figure of Merit**

(Receiving Sensitivity + Transmitting Sensitivity)



## Ultrasonic Sensor – 1.5 m Measuring Distance

US040015

The US040015 is an ultrasonic sensor of asymmetrical beam patterns, approximates  $\pm 60^\circ/40^\circ$  for horizontal/vertical, which mostly suits for car reversing aids.

Thanks to our new developed [Sonar Ranging Chip PW-0268](#) that makes our US040015 in such small dimensions.

The US040015 needs only three wires connection, positive power, ground and I/O digital signal. The I/O digital signal connection is a bi-direction port and is designed as an open collector connection with an internal pull high resistor. When the I/O port is being pulled low by an external transistor, the sensor is activated, and after excitation duration, which is decided by the control pulse, the I/O port will again go low if a valid echo signal is detected.

Please be aware that US040015 is not a complete proximity sensor. It is a solution dealing with all analog signals and converts them to digital signals for further processes. See detail of [Ultrasonic Proximity Sensors](#)

### Features:

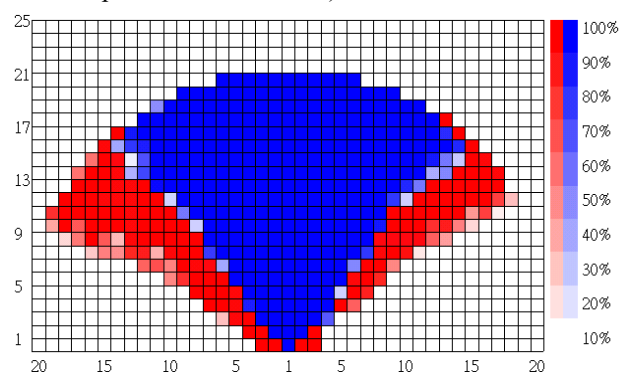
- Echo ranging distance from 0.25 m to 1.5 m
- Asymmetrical beam patterns:  
Horizontal Beam: around  $\pm 60^\circ$   
Vertical Beam: around  $\pm 40^\circ$
- Automatic frequency tracing minimizes temperature influence
- Bi-directional digital I/O port
- Water-proof construction
- Miniature size
- Flexible mounting



### Specification:

Operation voltage	DC6 – 12V
Current consumption	<30 mA @DC10V
Signal voltage levels	
Input	Low 0.15 * Vcc
High	0.4 * Vcc
Output	Low 0.05 * Vcc
High	0.9 * Vcc
Operation frequency	40 – 45 KHz
Measuring rate (max.)	50 Hz
Measuring range	25 – 150 cm
Beam Horizontal	120°
Pattern Vertical	80°
Control pulse (max.)	600 $\mu$ s
Ringing (max.)	1100 $\mu$ s
Protection level	IP 65
Operation temperature	-40° ~ +85°C

**Beam Pattern:** (against a 7.5 cm rod-shaped target, each cell presents 7.5 \* 7.5 cm)



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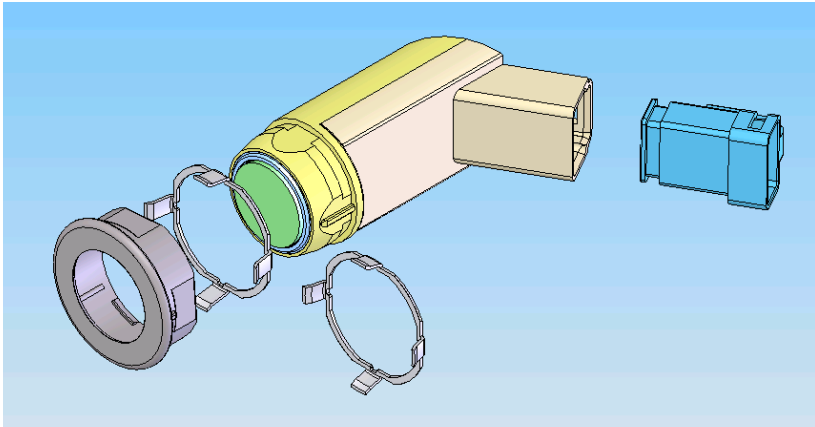
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## Ultrasonic Sensor – 1.5 m Measuring Distance

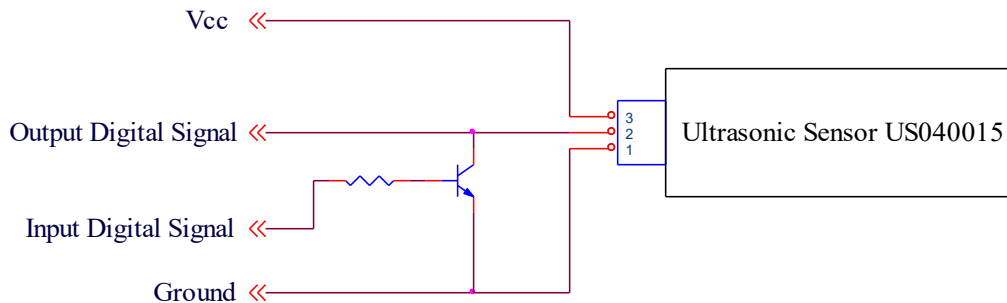
US040015

### Accessories:

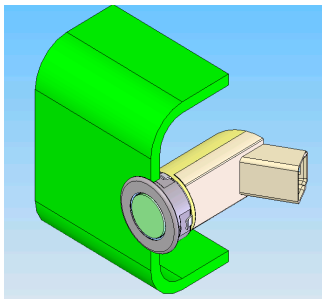


1. Sensor Body
2. Front Cover
3. Spring Clips for installation; two clips "a" and "b"
4. 3 Wires Connector (specify wire length when ordering)

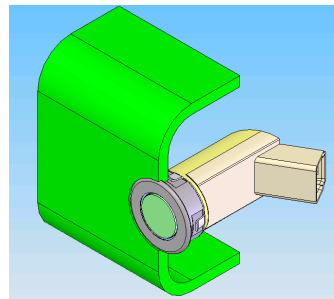
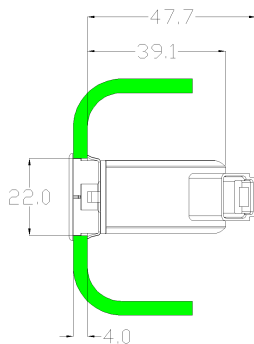
### Circuit diagram:



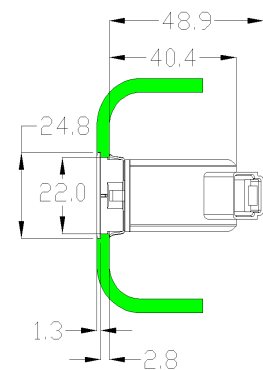
### Installations:



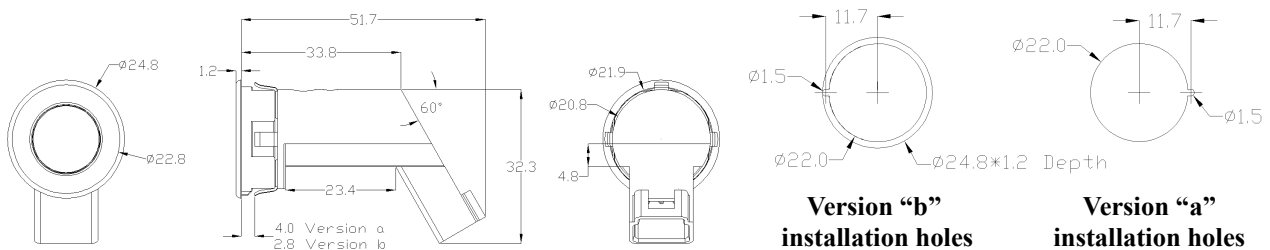
Φ22 mm straight through hole with version "a" spring clip



Φ24.8 \* 1.2 mm depth, Φ22 mm straight through hole with version "b" spring clip



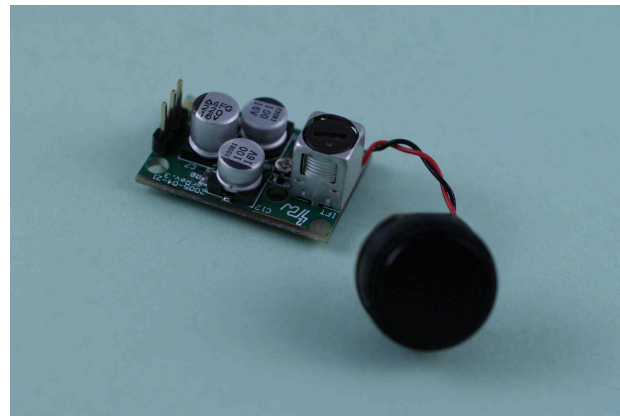
### Dimensions:



The SRM400 is a sonar ranging module utilizing our new developed Sonar Ranging IC, PW-0268, which can work with all our PT or EP type transducers. SRM400 provides as a shortcut to develop car reversing systems or some other distance measurement systems for design engineers who are not very familiar with analog circuit and/or the operation of ultrasonic transducers. By using this module engineers can focus firstly on the other fields of digital circuit and software designs as well as some other mechanical issues. After first stage then you can either design your own analog circuit based on the module construction or consult with factory for making your own module for your special needs.

#### Features:

- Operating Voltage: 6-12Vdc single source
- Operating Frequency: broadband output ranging up to 250KHz
- Built-in variable RC oscillator matching transducers with different frequencies
- High Gain Amplifier: varies with time over 32 steps
- Integrated Band Pass Filter: reduces external component count,
- Bi-direction I/O Pin: simplifies the control function for transmitting a pulse and receiving an echo
- An adjustable System Clock: enables the control of, the number of pulses transmitted, the slope of the variable gain amplifier, and the pulse repetition rate
- Board size: 27.9 \* 18 mm (L\*W)



#### Specification:

Operation voltage	DC6 - 12V
Operation current	<30 mA @DC12V, pulse width 0.5ms, ≥20ms Repetition rate
Oscillation frequency	Variable RC oscillator
Amplifier gain	
Pre-Amplifier	14 dB
2 <sup>nd</sup> Stage	30 dB
Amplifier	
Time controlled 32 steps main amplifier	35 dB max.
Bandpass filter	
Fc	38 KHz
Bandwidth	20 KHz
Insertion loss	1 dB
Bi-directional I/O	
Input signal	Open collector pull low
Output	0.05*Vcc to 0.9*Vcc digital echo signals
Measuring distance	25 – 150 cm

#### SRM400 includes:

1. Module board
2. 400EP14D enclosed type transducer of asymmetrical beam patterns, see detail specification of 400EP14D.
3. Detail electrical schematic



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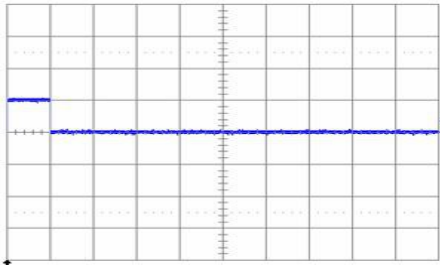
[Http://www.pro-wave.com.tw](http://www.pro-wave.com.tw) ; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw) ; Tel: 886-2-22465101 ; Fax: 886-2-22465105



**Waveforms at different test points:**

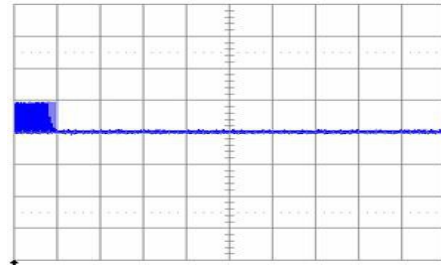
works with transducer model 400EP14D against a hard target of size of 20cmL\*20cmW\*1cmT at distance of 50cm

**“A” Point:** Control Pulse (from MCU)



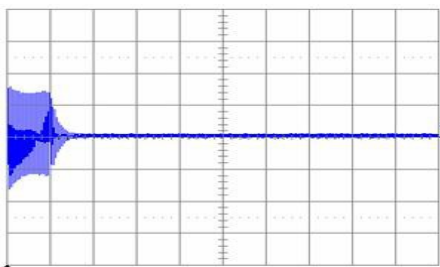
H: 0.5ms/div  
V: 5V/div

**“B” Point:** Tone bursts Signal



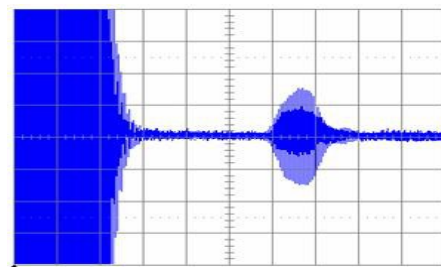
H: 0.5ms/div  
V: 5V/div

**“C” Point:** Transducer loading



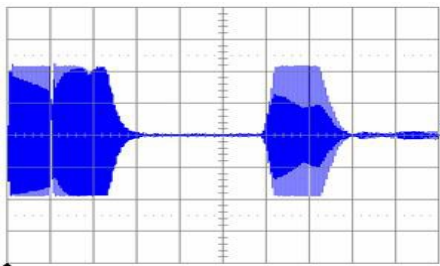
H: 0.5ms/div  
V: 50V/div

**“D” Point:** 1<sup>st</sup> Pre-Amplifier



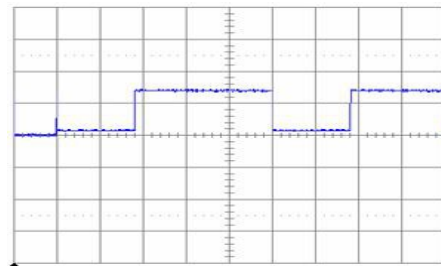
H: 0.5ms/div  
V: 20mV/div

**“E” Point:** Main 32 Steps TCG Amplifier



H: 0.5ms/div  
V: 1V/div

**“F” Point:** Digital Echo signal Output



H: 0.5ms/div  
V: 5V/div

Refer to [PW-0268 Sonar Ranging IC](#) for detail information.

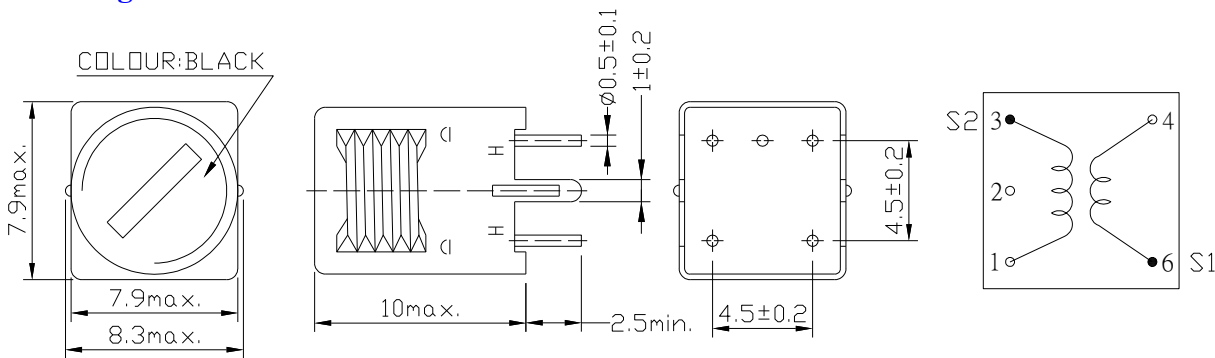


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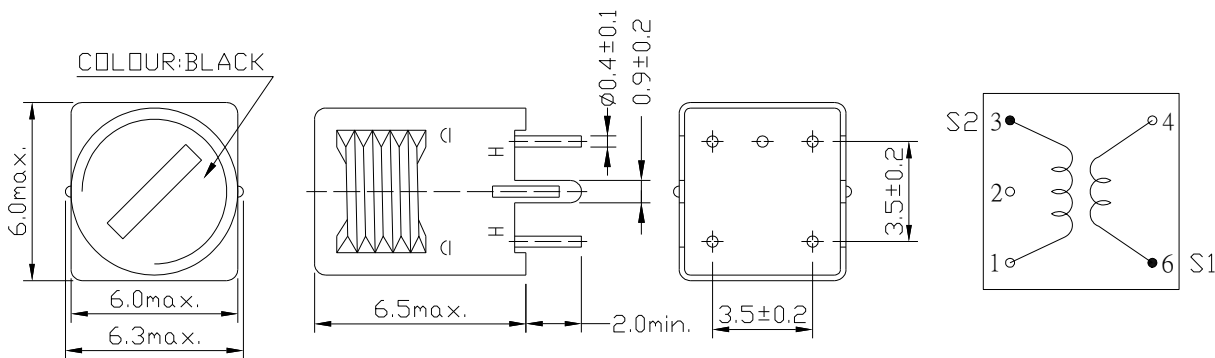
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**Matching Transformers**

**Matching Transformers**



(Figure 1)



(Figure 2)

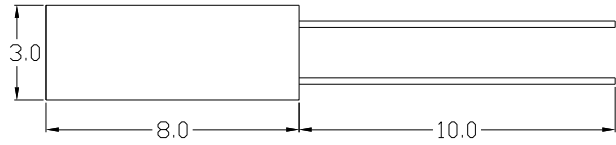
**Specification**

Parts Number	K4000001	K4000002	K4000003	K4000004	K4000005
Operating Frequency	40.0 KHz	40.0 KHz	235.0 KHz	40.0 KHz	125.0 KHz
Variable Inductance (min.)	10.6 mH± 6%	5.3 mH± 6%	1.0 mH± 6%	6.0 mH± 6%	1.5 mH± 6%
Unloaded Q (min.)	70	100	25	90	80
Turn Ratio	1:10				1:20
Matching Transducer	400EP14D	400EP14D*	235SR130	400EP18A	125SR250
Dimensions	Figure 1		Figure 2	Figure 1	

\*(Temperature Compensated Type)

## Quartz Crystals

### Miniature Tuning Fork Quartz Crystals



### Specification

Model Number	S40000	S32800
Nominal Frequency (Hz)	40,000 Hz	32,768 Hz
Tolerance at 25 ° C (PPM)	± 60	± 20
Temperature Stability (-10 °C to +70 °C) (PPM)	± 45	± 30
Load Capacitance (pF)	12.5	
Series Resistance (Ohm)	35,000	
Shunt Capacitance (pF)	2.3	
Drive Level (mW)	0.001	



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## Piezoelectric Ceramic Elements

Pro-Wave's new piezoelectric ceramic elements are designed for sensor and actuator uses. A series of standard elements covering a wide range of geometric shapes and sizes are provided. The in-house R&D expertise and machining facilities enable quick delivery of custom designed devices and elements. Piezoelectric films of polyvinylidene difluoride (PVDF<sub>2</sub>) and PZT thick films are also available for special applications.

In addition to ceramic elements, piezoelectric ceramic powders ready for press and forming are also available. Typical piezoelectric values are listed below for design purpose.



Standard tolerances are 20%. These ceramics feature wide firing range and are optimized for ease in poling and low ageing characteristics.

### Specification

Property	Unit	S5A	S5B	S4	S8
Coupling Coefficient, Kp(%)	%	66	65	59	58
Frequency Constant	Hz·m	2000	1950	2100	2200
Relative Dielectric Constant	$\epsilon/\epsilon_0$	2000	2500	1100	1400
Dissipation Factor	%	1.8	2.0	1.0	0.5
Piezoelectric Coefficient, d31	$10^{-12}$ m/V	-195	-190	-120	-120
Piezoelectric Coefficient, d33	$10^{-12}$ m/V	360	360	240	220
Piezoelectric Coefficient, g31	$10^{-12}$ V·m/N	-12	-10	-10	-9
Piezoelectric Coefficient, g33	$10^{-12}$ V·m/N	22	18	24	16
Mechanical Q		60	70	500	1000
Curie Temperature	°C	310	290	280	280
Density	g/cc	7.8	7.6	7.8	7.8



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## Piezoelectric Film Sensors

Pro-Wave now presents a series of mechno-electrical sensors and detectors produced by advanced piezoelectric polymer film technology. The polymer film of polyvinylidene fluoride (PVF2) exhibits a conspicuous piezoelectric effect and also has high compliance comparing with other piezoelectric crystals or ceramic materials. Because of its superior piezoelectric strain constant (g value), 10-20 times larger than piezoelectric ceramic, it is an ideal sensing material for converting mechanical to electrical energy.

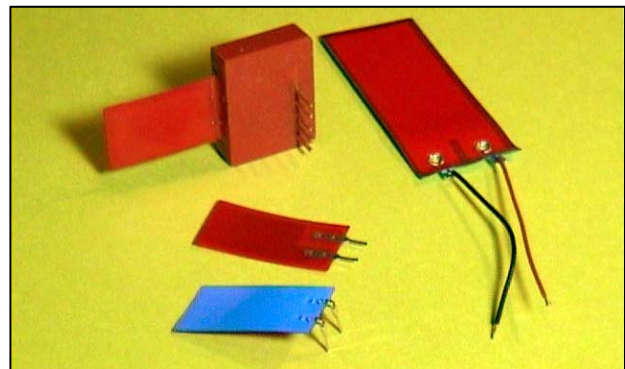
Besides the standard products shown on this catalogue, we are also developing a series of sensing devices by using this particular piezoelectric thin film material. Please contact with us for your special needs.

### Features

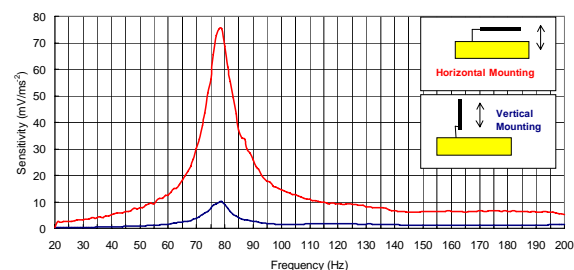
- High Mechno-electrical coefficient in planar, thickness and hydrostatic modes
- Low mechanical and acoustic impedance
- High resistance to moisture
- Pliant, flexible, tough and lightweight
- Self-generated voltage, non-contact, rustless, free of sparking

### Applications

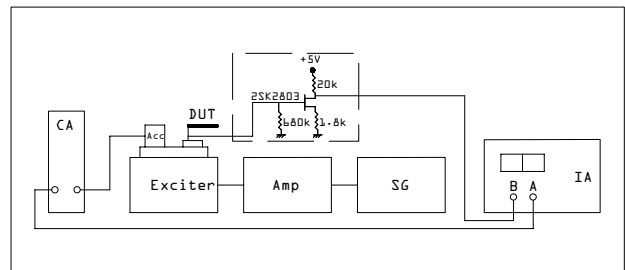
- Vibration sensors and motion detectors
- Low weight accelerometers
- Pressure or force sensors
- Keyboards, keypads and touch panels
- Coin and impact sensors
- Microphones and headset speakers
- Other mechno-electrical and electro-mechanical devices



### Frequency response



### Measuring diagram



**SG:** Programmable Signal Source HP 8165A

**Amp:** Power Amplifier

**Exciter:** Exciter B&K 4809

**Acc:** Accelerometer B&K 8309

**DUT:** Device (FS-2513P) under test

**CA:** Charging Amplifier B&K 2635

**IA:** Impedance Analyzer HP4192



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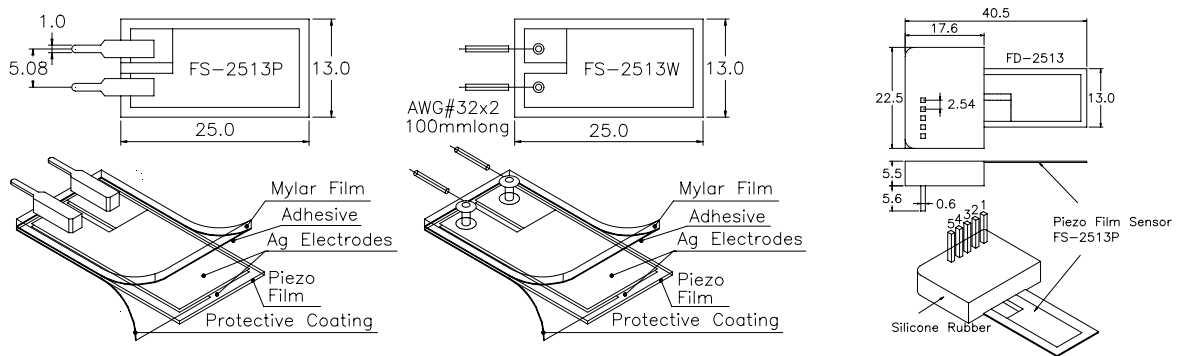


## Piezoelectric Film Sensors

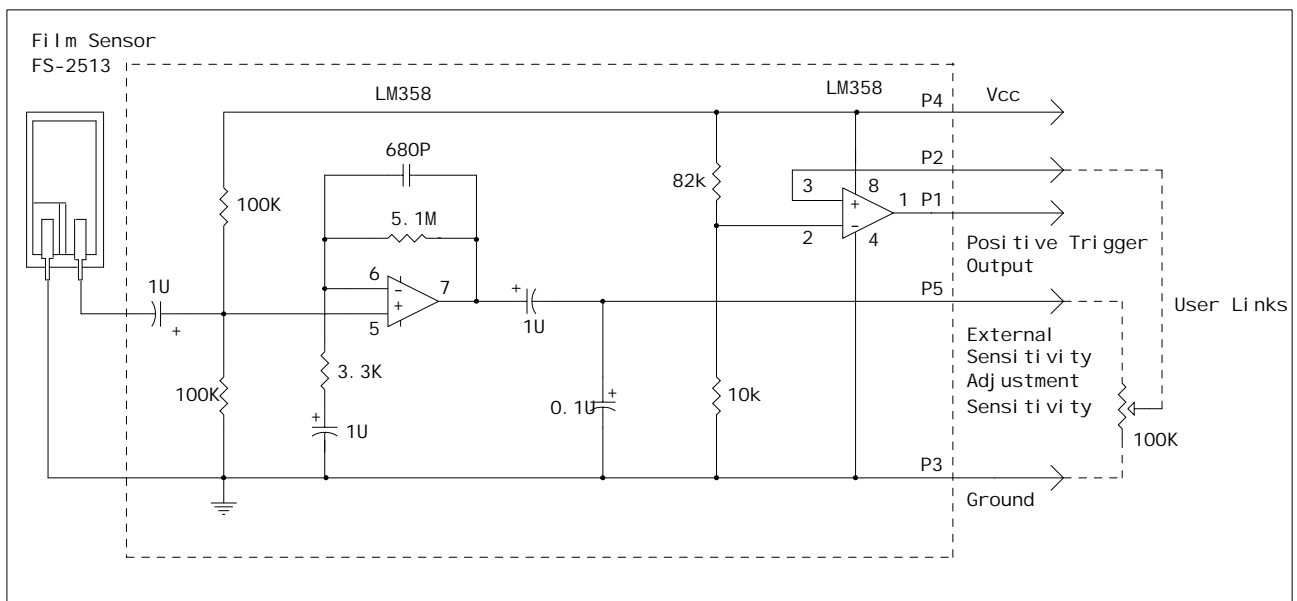
### Specifications

Model Number	FS-2513P	FS-2513W	FD-2513P	Unit
Type	Lead Pins	Lead Wires	Lead Pins	-
Voltage sensitivity at fr	70	70	-	$\text{mV/ms}^{-2}$
Transverse sensitivity	10	10	-	$\text{mV/ms}^{-2}$
Resonant frequency (fr)	$80 \pm 10$	$80 \pm 10$	-	Hz
Capacitance	$1.5 \pm 30\%$	$1.5 \pm 30\%$	-	$\eta\text{F}@1\text{KHz}$
Operation voltage (Vcc)	-	-	3-30	DC volts
Operation current	-	-	1	mA
Max. output current	-	-	20	mA
Operation temperature	-20 - +60	-20 - +60	-20 - +60	$^{\circ}\text{C}$
Storage temperature	-40 - +70	-40 - +70	-40 - +70	$^{\circ}\text{C}$

### Dimensions in mm



### Driving circuit & pin assignment of model FD-2513P



## Piezoelectric Buzzer Elements



### External-Drive Type

Model No.	Resonant Frequency (KHz)	Resonant Impedance ( $\Omega$ max.)	Capacity (pF)	Dimensions(mm)				Metal Plate Material
				D	d	T	t	
PWE-12B12	12.0 $\pm$ 1.0	1,500	4,500 $\pm$ 30%	12.0	8	0.33	0.15	Brass
PWE-12B49	4.9 $\pm$ 1.0	500	15,000 $\pm$ 30%	12.0	9	0.12	0.05	Brass
PWE-15B58	5.8 $\pm$ 0.5	500	10,000 $\pm$ 30%	15.0	10	0.23	0.10	Brass
PWE-15B40	4.0 $\pm$ 0.5	1,500	10,000 $\pm$ 30%	15.0	10	0.17	0.05	Brass
PWE-15B91	9.1 $\pm$ 1.0	500	7,000 $\pm$ 30%	15.0	10	0.38	0.20	Brass
PWE-20B38	3.8 $\pm$ 0.5	200	25,000 $\pm$ 30%	20.0	15	0.28	0.15	Brass
PWE-20B41	4.1 $\pm$ 0.5	300	17,000 $\pm$ 30%	20.0	15	0.28	0.10	Brass
PWE-20B64	6.4 $\pm$ 0.5	200	12,000 $\pm$ 30%	20.0	15	0.43	0.20	Brass
PWE-27B10	10.5 $\pm$ 1.0	500	12,000 $\pm$ 30%	27.0	15	0.48	0.25	Brass
PWE-27B20	2.0 $\pm$ 0.3	300	45,000 $\pm$ 30%	27.0	20	0.23	0.10	Brass
PWE-27B28	2.8 $\pm$ 0.5	300	30,000 $\pm$ 30%	27.0	20	0.33	0.15	Brass
PWE-27B44	4.4 $\pm$ 0.5	200	18,000 $\pm$ 30%	27.0	20	0.53	0.25	Brass
PWE-31A13	1.3 $\pm$ 0.3	800	43,000 $\pm$ 30%	31.0	20	0.23	0.10	42 Alloy
PWE-35B18	1.8 $\pm$ 0.5	250	50,000 $\pm$ 30%	35.0	25	0.33	0.15	Brass
PWE-35B26	2.6 $\pm$ 0.5	200	30,000 $\pm$ 30%	35.0	25	0.53	0.25	Brass
PWE-35B29	2.9 $\pm$ 0.5	200	30,000 $\pm$ 30%	35.0	25	0.58	0.30	Brass
PWE-41B07	0.7 $\pm$ 0.3	1,500	70,000 $\pm$ 30%	41.0	25	0.23	0.10	Brass
PWE-41A08	0.8 $\pm$ 0.3	1,000	70,000 $\pm$ 30%	41.0	25	0.23	0.10	42 Alloy
PWE-50B28	2.8 $\pm$ 0.5	200	35,000 $\pm$ 30%	50.0	25	0.43	0.20	Brass

### Self-Drive Type

Model No.	Resonant Frequency (KHz)	Resonant Impedance ( $\Omega$ max.)	Capacity at 1KHz (pF)	Dimensions(mm)				Metal Plate Material
				D	d	T	t	
PWE-12B49F	4.9 $\pm$ 1.0	1,000	12,000 $\pm$ 30%	12.0	9	0.12	0.05	Brass
PWE-15B58F	5.8 $\pm$ 0.5	1,000	7,500 $\pm$ 30%	15.0	10	0.23	0.10	Brass
PWE-20B38F	3.8 $\pm$ 0.5	350	17,000 $\pm$ 30%	20.0	15	0.28	0.15	Brass
PWE-20B64F	6.4 $\pm$ 0.5	300	10,000 $\pm$ 30%	20.0	15	0.43	0.20	Brass
PWE-27B44F	4.4 $\pm$ 0.5	300	15,000 $\pm$ 30%	27.0	20	0.53	0.25	Brass
PWE-35B26F	2.6 $\pm$ 0.5	300	25,000 $\pm$ 30%	35.0	25	0.53	0.25	Brass
PWE-35B29F	2.9 $\pm$ 0.5	300	25,000 $\pm$ 30%	35.0	25	0.53	0.30	Brass



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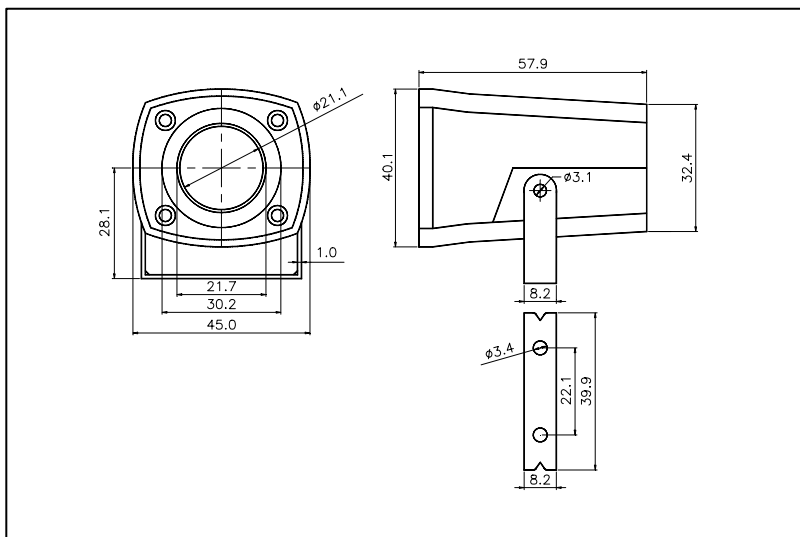
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**Specification**

<b>SQ-4558B</b>	Micro Piezo Siren
<b>Resonance Frequency</b>	3.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	105dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	200 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm

**Application:**

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

**Features:**

**High efficiency**  
**Micro and compact construction**  
**Waterproof and dust-proof**  
**Light weight**  
**Low cost**



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**Specification**

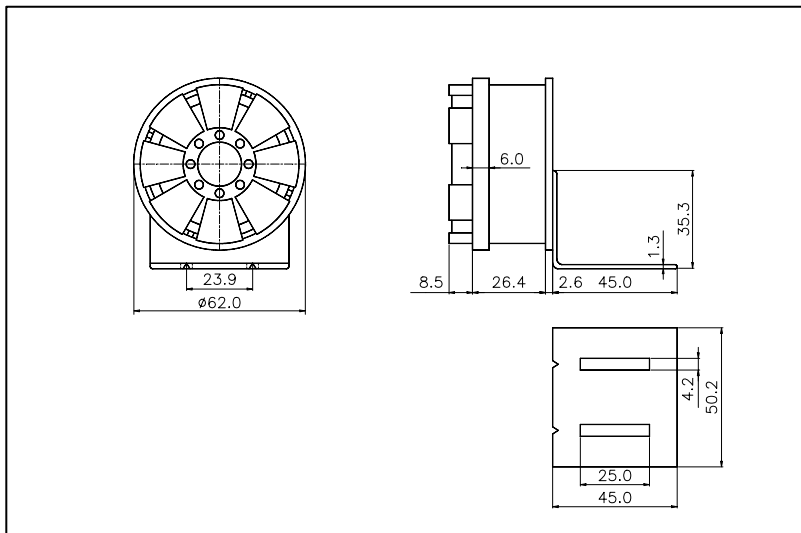
<b>SQ-6038B</b>	Piezo Siren
<b>Resonance Frequency</b>	2.5±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	110dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	300 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C

Operation voltage of DC 24/26/48 volts are available upon request.

\*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm

**Application:**

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**Signaling alarms**  
**Smoke detectors**  
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## Piezoelectric Ceramic Siren

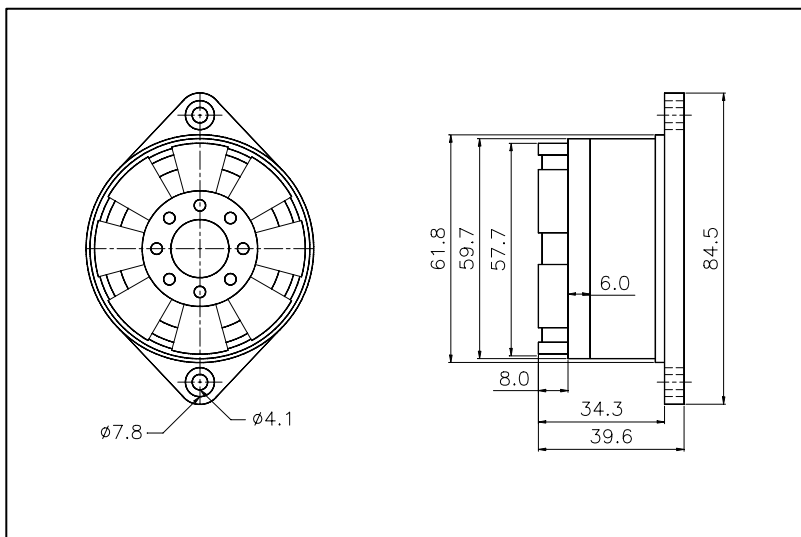
SQ-6038H

## Specification

<b>SQ-6038H</b>	Piezo Siren
<b>Resonance Frequency</b>	2.5±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	110dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	300 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Fringe
<b>Color*</b>	Black; Ivory
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm



## Application:

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
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## Piezoelectric Ceramic Siren

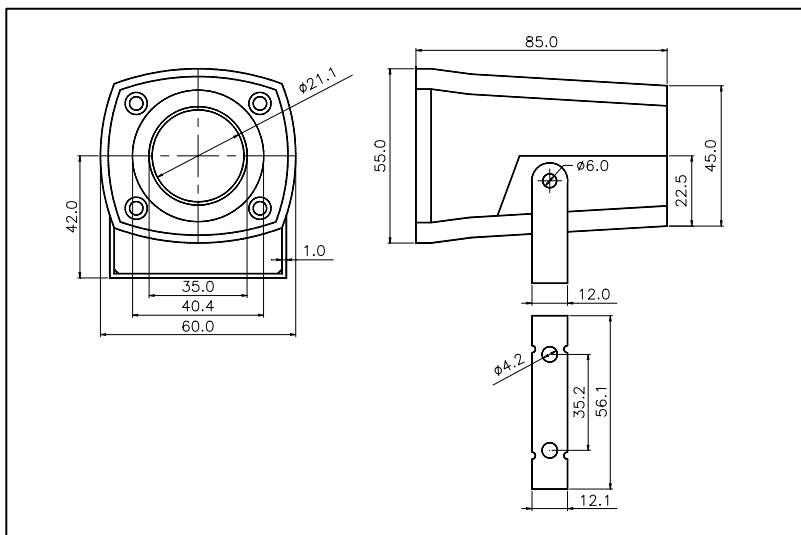
SQ-6085B

## Specification

<b>SQ-6085B</b>	Piezo Siren
<b>Resonance Frequency</b>	2.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	115dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	350 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm



## Application:

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

## Features:

**High efficiency**  
**Micro and compact construction**  
**Waterproof and dust-proof**  
**Light weight**  
**Low cost**



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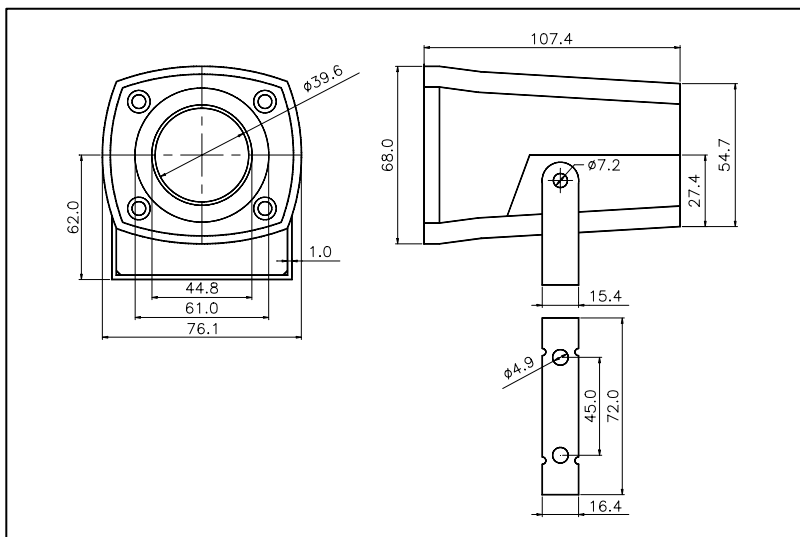
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**Specification**

<b>SQ-7608B</b>	Piezo Siren
<b>Resonance Frequency</b>	3.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	117dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	500 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm

**Application:**

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

**Features:**

**High efficiency**  
**Micro and compact construction**  
**Waterproof and dust-proof**  
**Light weight**  
**Low cost**



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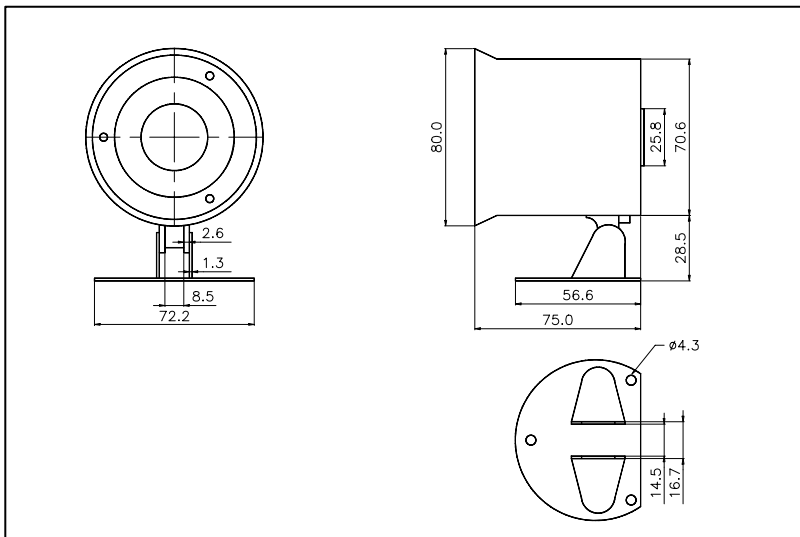
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**Specification**

<b>SQ-8075B</b>	Piezo Siren
<b>Resonance Frequency</b>	3.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	117dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	500 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm

**Application:**

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

**Features:**

**High efficiency**  
**Micro and compact construction**  
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## Piezoelectric Ceramic Siren

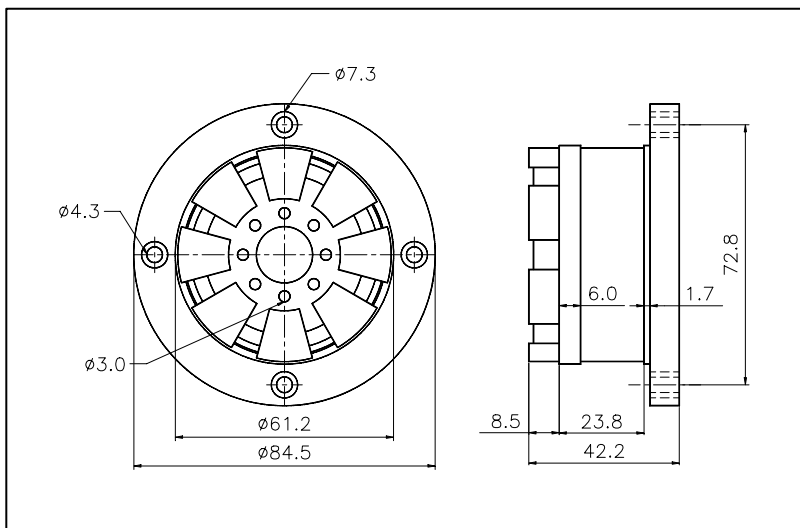
SQ-8543H

## Specification

<b>SQ-8543H</b>	Piezo Siren
<b>Resonance Frequency</b>	2.5±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	110dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	300 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Fringe
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm



## Application:

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

## Features:

**High efficiency**  
**Micro and compact construction**  
**Waterproof and dust-proof**  
**Light weight**  
**Low cost**



**S. Square Enterprise Company Limited**  
**Pro-Wave Electronics Corporation**

P.O. Box 1-70 Chung Ho, Taiwan; E-mail: [sales@pro-wave.com.tw](mailto:sales@pro-wave.com.tw); Tel: 886-2-22465101(5 lines), 22459774; Fax: 886-2-22465105  
<http://www.s2.com.tw> ; <http://www.prowave.com.tw>

## Piezoelectric Ceramic Siren

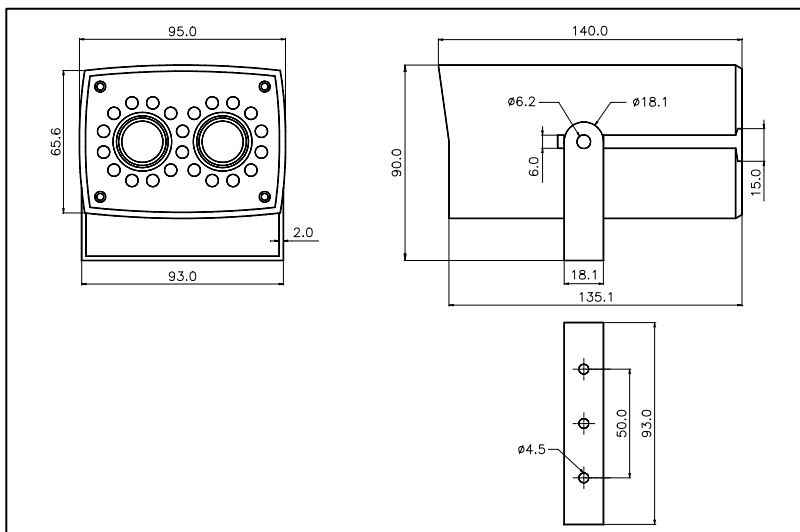
SQ-9014B

## Specification

<b>SQ-9014B</b>	Dual Piezo Siren
<b>Resonance Frequency</b>	2.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	122dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	1000 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm



## Application:

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

## Features:

**High efficiency**  
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## Piezoelectric Ceramic Siren

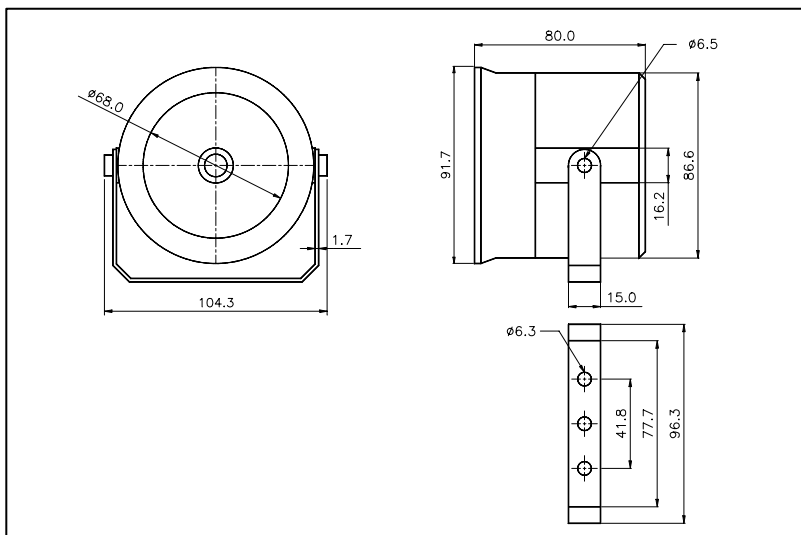
SQ-9280B

## Specification

<b>SQ-9280B</b>	Piezo Siren
<b>Resonance Frequency</b>	3.0±0.3Khz
<b>Sound Pressure Level</b> Rated at DC 12 volts @100cm 0dB re 0.0002μbar	120dB min.
<b>Operation Voltage</b>	DC 7-15 volts
<b>Current Drain</b> Rated at DC 12 volts	500 mA
<b>Tone Type*</b>	Sweep from 2-4Khz in 2Hz rate
<b>Case Material</b>	ABS Resin
<b>Mounting Type</b>	Metal Bracket
<b>Color*</b>	Black
<b>Operation Temperature</b>	-20 to 60°C
<b>Storage Temperature</b>	-30 to 70°C

All specification taken typical at 25°C  
 Operation voltage of DC 24/26/48 volts are available upon request.  
 \*Other tone type and color can be arranged upon request.

**Dimensions:** dimensions are in mm



## Application:

**Burglar alarms**  
**Warning devices**  
**Signaling alarms**  
**Smoke detectors**  
**Swimming pool alarms**  
**Distress signals, etc.**

## Features:

**High efficiency**  
**Micro and compact construction**  
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Pro-Wave is a well-known manufacturer of various sensors and transducers and the basic sensing materials of piezoelectric ceramic and piezoelectric polymer films.

Our **GBD** series glass break detectors utilize the advance sensing technology of acoustic emission which only be responded in the frequency containing in the frequency over 200Khz of overtone frequencies containing in the frequency spectrum while glass being broken. It is unlike the microphone type detectors that can be easily activated by audible sounds and vibrations.

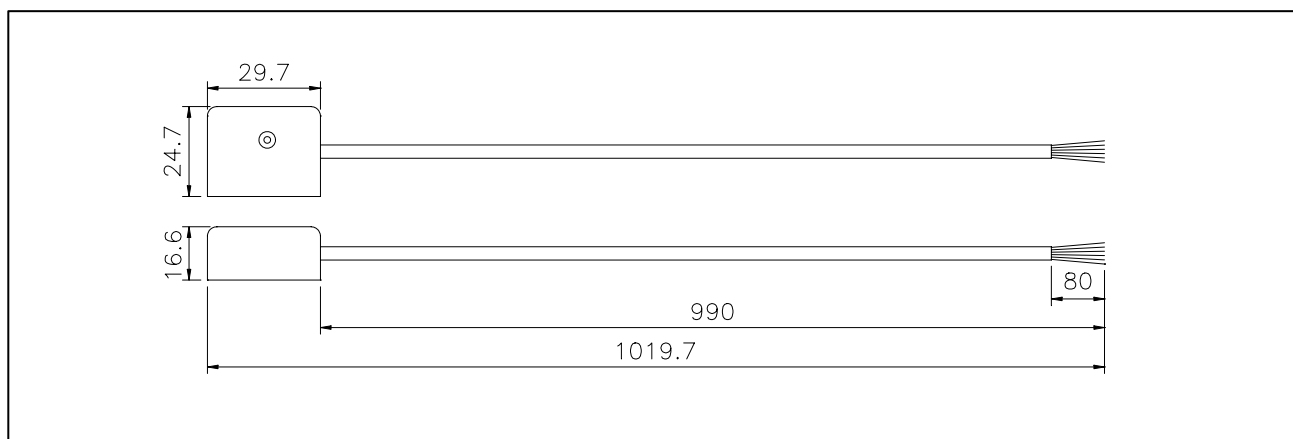
Up to 20 GBD series detectors can be wired in series and linked with all type security systems.



### Features

- Reliable ultrasonic emission sensing
- Latching LED indication
- Momentary opening contact
- Anti-tamper look wires
- Up to 20 detectors wired in series
- High impact resin enclosure

### Dimension



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## Glass Break Detector

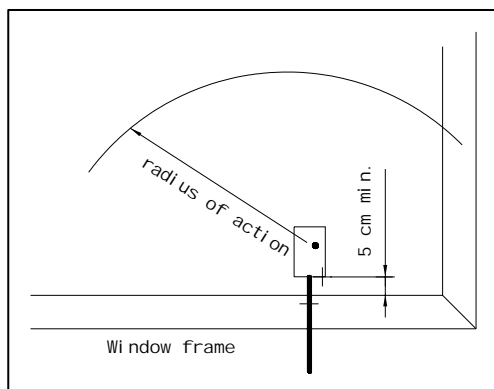
GBD-02

### Specification

	GBD-02W	GBD-02B
Supply voltage	DC 11-15 volts	
Current consumption (standby)	2.5mA at DC 12 volts	
Contact rating	30 volts (maximum voltage) 0.5 Ampere (maximum current) 10VA (maximum power)	
Size	30.2 mm (length) x 25.3 mm (width) x 16.5 mm (height)	
Cable length	2 meters	
Color (ABS housing)	White	Brown

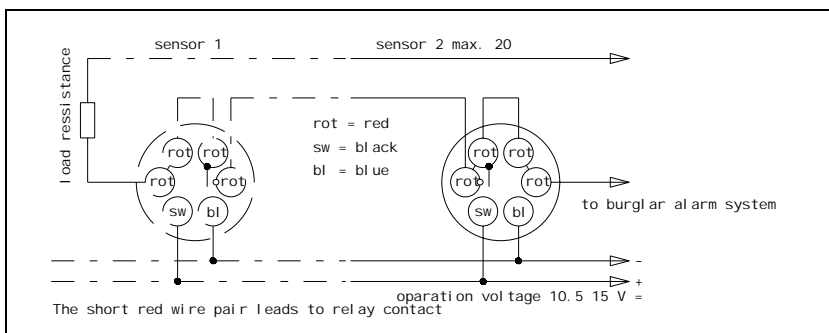
### Mounting

After cleaning a suitable area of the windows (at least 5 cm away from any window frame with the cable going to the side or down) and **GBD** detector back with spirit cleaner (no nitro cleaner). The **GBD** detector is glued on the window with a temperature resistance glue, for example, RTV silicone rubber. The sensitivity depends on the glass thickness and reaches a maximum of 1.5 meter.



Glass thickness	Radius of action
8 mm	1.5 m
6 mm	1.5 m
4 mm	1.2 m
2 mm	0.6 m

### Connection



One or up to 20 **GBD** detectors can be wired in series according to the connection diagram including a termination resistor (4.7 – 22K Ohm). The wires of red and white are the relay output wires, the wires of yellow and brown are anti-tamper loop

wires, the blue one is the power input wire of DC –12 volts, the black wire is the power input of DC +12 volts.

## Piezoelectric Blood Pressure Sensors

Pro-Wave's new line of piezoelectric pressure sensors are designed specially for digital blood pressure monitors, which has one piece molded air pressure pipe bonded with sensor cable.

All piezoelectric pressure sensors are supplied with a high sensitivity piezoelectric ceramic element glued with a metal diaphragm by using a rigid bonding agent. A built-in low noise junction field effect transistor housed in a plated metal housing. Standard version of piezoelectric pressure sensor has an 1.3 meter of one piece shielding cable bonding with air pressure pipe, and a molded 2.5 mm diameter phone plug at other cable end.



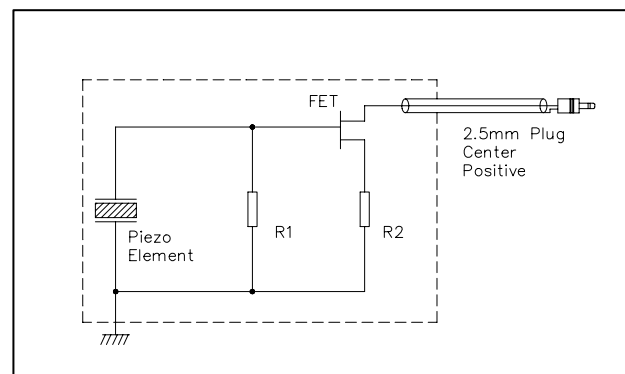
### Features

- High mechno-electrical sensitivity
- Low impedance output
- Wide operation temperature
- Molded air pressure pipe bonded with shielding cable

### Applications

- Sensors for digital blood pressure monitor
- Sensors for machine health monitors
- Sensors for car burglar alarms home security and etc.

### Equivalent circuit



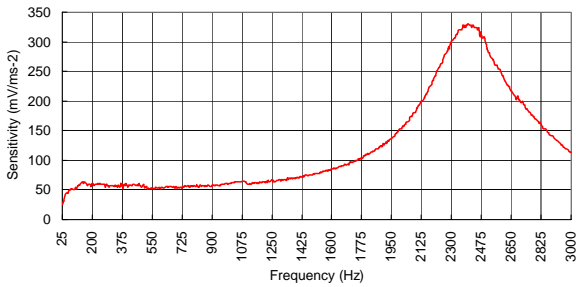
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## Piezoelectric Blood Pressure Sensors

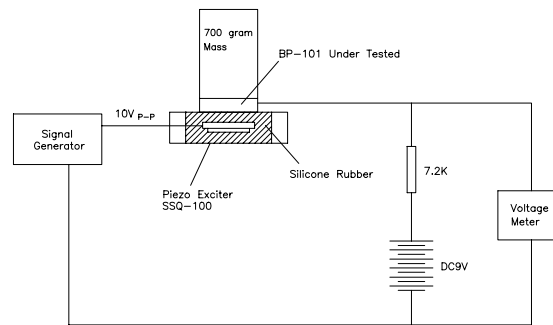
### Specification

Model number	BP-2401 (with air pressure pipe) BP-2402 (without air pressure pipe)
Voltage sensitivity	40mV/ms <sup>-2</sup>
Lower frequency limit	30Hz
Upper frequency limit	1000Hz
Resonant frequency	2,400 ± 20% Hz
Operation voltage	DC 3 – 30 volts
Operation temperature	-20 to +60°C
Storage temperature	-40 to +80°C

### Frequency Response



### Measuring Circuit



### Dimension

