

star[★] PRODUCTS

"Magnetic Sounder & Buzzer, Dynamic Speaker" Catalog (RoHS Compliant Products)

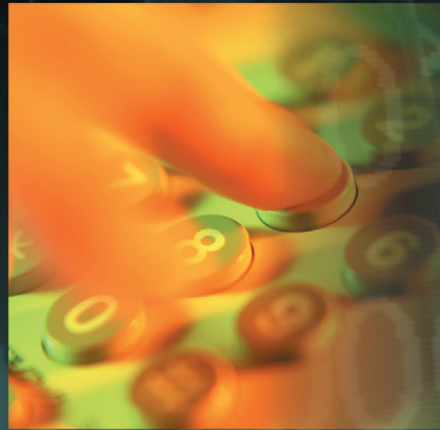


SOUND DEVICE

"Magnetic Sound"

The culmination of over fifty years of manufacturing expertise has resulted in a wide range of audio products providing high quality and reliability.

Star Micronics is one of the world's largest manufacturers of magnetic buzzers, speakers, receivers and other audio products. Our products are manufactured in facilities throughout the world using the latest factory automation and computer integration systems. This system ensures high productivity and high quality products that are sold worldwide and backed by an extensive marketing network that stretches across the globe.



- Star ensures the highest possible standards of manufacture, product quality and reliability. Our audio products have acquired the ISO9001, ISO/TS16949, and ISO14001 certification.



- Star audio products are sold into applications such as automotive, wireless communications, medical instrumentation, test equipment, computer peripherals, appliances, general industrial, alarms and more.

G U I D A N C E

How to View the Overall Product Catalog

Washable / Non-washable during mounting

Non-washable

MLT-G series

Type

Model

Icon

Name of EIAJ Standards

Reflow Reflow type -Durable to lead- free oven.

Auto Mounting Tape and reel packaging for auto mounting

Dip Dip-solder type

High SPL High sound pressure level

Wide Frequency Wide frequency band

Low Frequency Low frequency band

Pin/Lead Pin terminals or lead wire type

Heat Resistant High heat resistant

Patent Design right or patent already registered by Star Micronics

Sound Port Side or upper sound port

Square/Sine Wave Drive Correspond to square or sin wave drive

Low Consumption

Control Term

MLT-03GC

Reflow **Auto Mounting** **Side Sound Port** **Patent**

Sounder & Buzzer, "Dynamic Speaker" Series

Manufacturing products with high output.

Manufacturers of magnetic sounders and microphones. Our products are available worldwide, featuring competitive prices on integrated sales and



C O N T E N T S

Product line-up index

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Magnetic Sounder

Reflow type (Non-washable)

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Magnetic Buzzer (Self-contained drive circuitry)

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Dynamic Speaker

Non-washable type

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Applications

- Mobile Devices . . . Mobile phone, PDA, Portable Audio player
- Kitchen Electronic oven, Timers
- Shop Appliance . . . Electronic registers, POS
- IT Equipment Computer terminal, Keyboard, Printer peripheral, Digital camera
- Automobile Automobile safety systems, Automobile phone, ETC, Car Navigation
- Medical, etc. Electronic sphygmomanometers, Disaster / Crime prevention equipment, Alarm clock, Various kinds of alarms

Low current consumption type

Equipped with control terminals for small input signal use

Magnetic Sounder

◆Reflow type (Non-washable) (Note 1)

Type	Model	Dimensions (mm)	Rated Voltage (V)	Operating Voltage (V)	Rated Frequency (Hz)	Sound Pressure Level (dBA) (Note 2) <MIN(10cm)>	Mean Current Consumption (mA) <MAX>	Operating Temperature (°C)	Mass (g)	Page
NFT	NFT-03C	5×5×3	3.0	~4.0	4,000	78	100	-30~+70	0.3	6
	NFT-03D	5×5×2	3.0	~4.0	4,500	78	110	-30~+70	0.3	6
MLT	MLT-03C	8.5×8.5×3	3.6	~4.5	2,700	88	100	-30~+70	0.5	7
	MLT-03GC	8.5×8.5×4	3.6	~4.5	2,700	94	100	-30~+70	0.5	7
	MLT-03HH		3.6	~4.5	3,000	96	100	-30~+70	0.5	8
MZT-A	MZT-03A-BLK	10×12×2	3.6	~4.2	2,670	83	70	-30~+70	0.5	8
MLT	MUT-01A	11×14×3	1.5	~1.7	3,200	85	65	-20~+70	1	9
	MUT-03A		3	~4.5	3,200	87	70	-20~+70	1	9



◆Non-washable type

Type	Model	Dimensions (mm)	Rated Voltage (V)	Operating Voltage (V)	Rated Frequency (Hz)	SPL (dBA) (Note 2) <MIN(10cm)>	Frequency Band (Hz) <MIN80dB>	Mean Current Consumption (mA) <MAX>	Operating Temperature (°C)	Mass (g)	Page
QCP-03A	QCP-03A	φ9×4.5	3.6	~4.3	2,670	85	—	90	-30~+60	1	10
QMB-105	QMB-105P	φ12×5.4	1.5	~2	2,048	70	—	10	-20~+60	2	10
QMB-108	QMB-108P	φ12×7.5	1.5	~2	2,743	85	—	60	-20~+60	1.6	11
QMB-111	QMB-111PN	φ12×8.5	1.5	~2	2,048	80	—	10	-20~+60	2	11
	QMB-111GPN		1.5	~2	2,048	85	—	35	-20~+60	2	11
	QMB-111PC		5	~5	2,000	85	—	40	-20~+60	2	11
PMX-06	PMX-06B	φ12×5.8	1.5	~2	2,731	83	—	70	-20~+60	2	12
PMX-04	PMX-04B	φ12×7.5	1.5	~2	2,731	85	—	70	-20~+60	2	12



◆Washable type (Note 3)

Type	Model	Dimensions (mm)	Rated Voltage (V)	Operating Voltage (V)	Rated Frequency (Hz)	SPL (dBA) (Note 2) <MIN(10cm)>	Frequency Band (Hz) <MIN80dB>	Mean Current Consumption (mA) <MAX>	Operating Temperature (°C)	Mass (g)	Page
QMX	QMX-05	φ12×9	5	~8	2,400	85	—	40	-40~+85	2	13
	QMX-12		12	~15	2,400	85	—	40	-40~+85	2	13
HGP	HGP-05AM	φ16×12	5	~8	—	85	1,700~2,200	70	-40~+90	4	13
	HGP-12AM		12	~15	—	85	1,700~2,200	50	-40~+90	4	13
RMX	RMX-06	φ16×14	6	~12	2,048	85	2,000~3,000	40	-40~+85	5	14
	RMX-12Y		12	~18	2,048	85	2,000~3,000	40	-40~+85	5	14
QMB	QMB-06S/L	φ16×14	6	~12	2,048	85	—	40	-40~+100	7	14
	QMB-12S/L		12	~18	2,048	85	—	40	-40~+85	7	14
TMX	TMX-12F	φ25×18	12	~16	850	95	—	40	-40~+85	9	15
	TMX-03H	φ25×12.5	3.6	~5	1,500	106	—	300	-40~+80	10	15
	TMX-05H	φ25×12.5	5	~6	1,500	104	—	80	-40~+85	9	15
	TMX-12H	φ25×12.5	12	~16	1,500	104	—	55	-40~+85	9	15
TMX-S3	TMX-06S3	φ25×12.5	6	~8	1,000	85	1,000~1,500	75	-40~+85	9	16
	TMX-12S3		12	~14	1,000	85	1,000~1,500	55	-40~+85	9	16



◆Reflow type for Automobile (Non-washable)

Type	Model	Dimensions (mm)	Rated Voltage (V)	Operating Voltage (V)	Rated Frequency (Hz)	SPL (dBA) <MIN(10cm)>	Frequency Band (Hz) <MIN80dB>	Mean Current Consumption (mA) <MAX>	Operating Temperature (°C)	Mass (g)	Page
NAT	NAT-05A	15×17×12	5	~7	2,000	88	1,700~2,300	80	-40~+85	3	17
	NAT-12V		12	~16	2,000	90	1,700~2,300	75	-40~+85	3	17



NAT-05A
NAT-12V

Buzzer

●Electric sound type (Washable) (Note 3)

Type	Model	Dimensions (mm)	Rated Voltage (V)	Operating Voltage (V)	Rated Frequency (Hz)	SPL (dBA) <MIN(10cm)>	Mean Current Consumption (mA) <MAX>	Operating Temperature (°C)	Mass (g)	Page
TMB	TMB-05	φ 12×9.5	5	4~6.5	2,300±300	85	30	-40~+85	2	19
	TMB-12		12	8~16	2,300±300	85	30	-40~+85	2	19
HMB	HMB-06	φ 16×14.5	6	4~7	2,200±300	85	30	-40~+85	5	19
	HMB-12		12	8~16	2,200±300	85	30	-40~+85	5	19



TMB-05
TMB-12



HMB-06
HMB-12

Dynamic Speaker

●Non-washable for Automobile

Type	Model	Dimensions (mm)	Nominal Input (W)	Max Input (W)	Impedance (Ω)	Resonance Frequency (Hz)	SPL (dBA) <MIN(10cm)>	Operating Temperature (°C)	Preservation Temperature (°C)	Mass (g)	Page
SAC	SAC-30C	φ 33.8×7	0.2	0.4	8±2	—	92	-40~+105	-40~+120	8.3	21
	SAC-30D	φ 31.5×14.8	0.2	0.4	8±2	—	92	-40~+105	-40~+120	8.3	21
SAE	SAE-20A	20×20×4.5	0.5	0.8	8±1.6	850±100	95±3	-40~+85	-40~+105	3.0	22
NDT	NDT-03C	15×15×4	0.5	0.8	8±1.6	800±100	90±3	-30~+85	-40~+105	1.6	22



SAC-30C



SAC-30D



SAE-20A



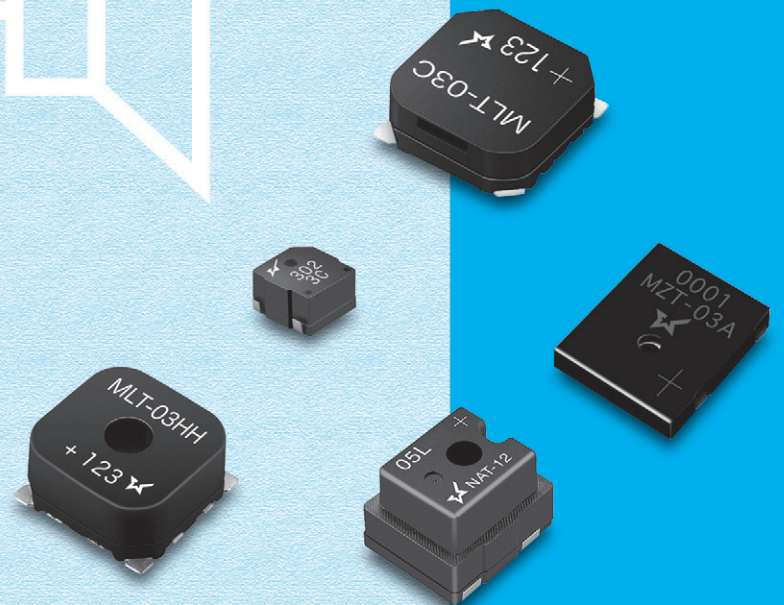
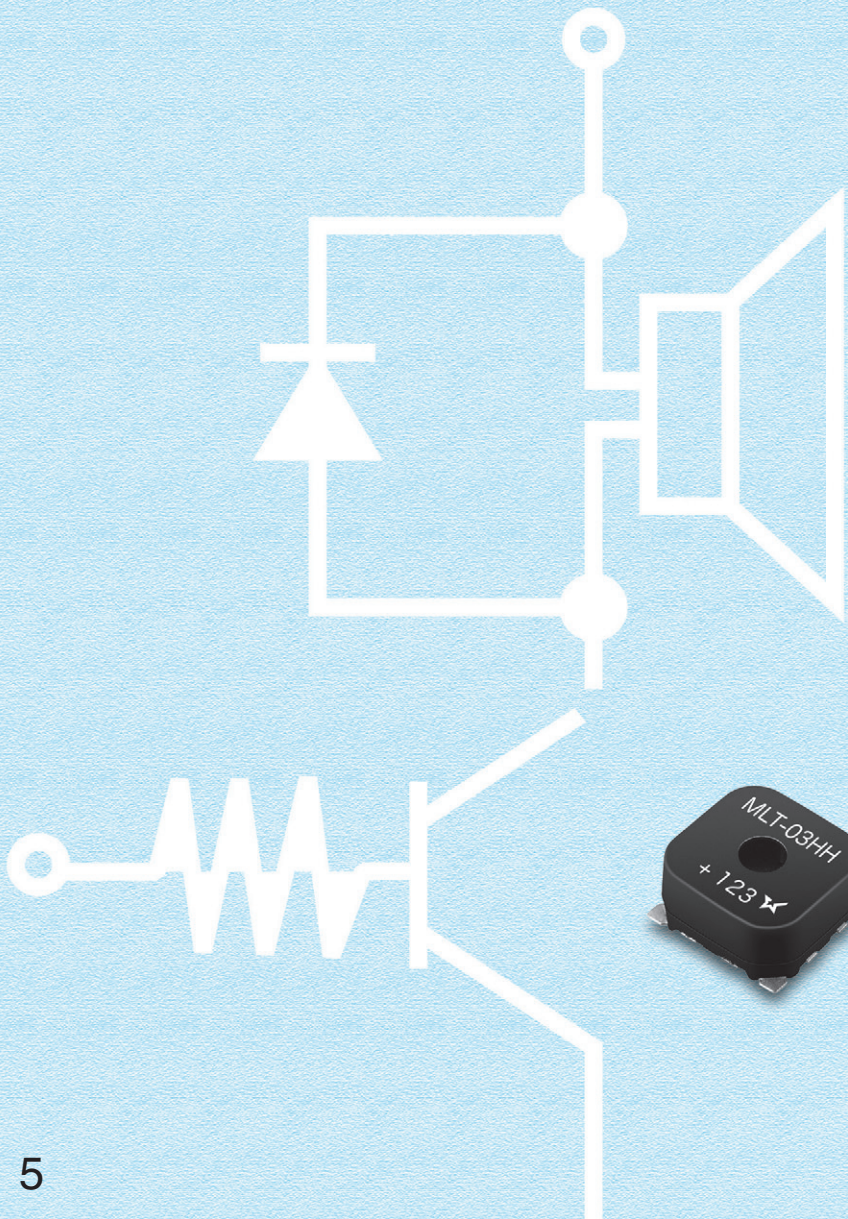
NDT-03C

Note 1 : Please contact us for conditions. These are Non-washable.

Note 2 : (dBA) = dB(A-weighting)

Note 3 : Please refer to page 29.

Magnetic Sounder



Non-washable

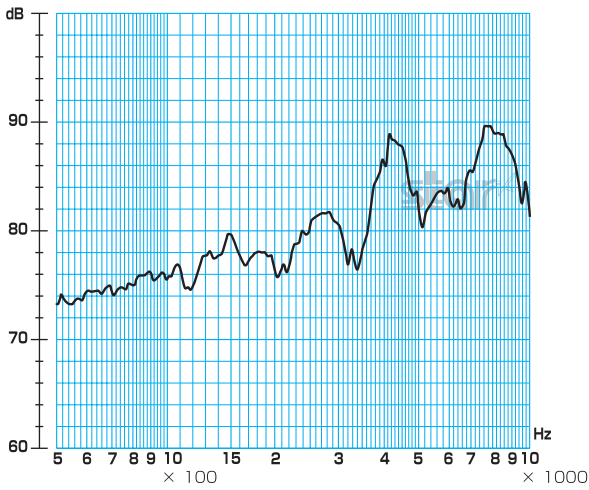
NFT series



NFT-03C

- Reflow
- Auto Mounting
- Upper Sound Port
- Patent
- Ultra Small

Frequency Response



applied voltage : 3V, square wave : 1/2 duty,
distance for measurement : 10cm with recommended cavity

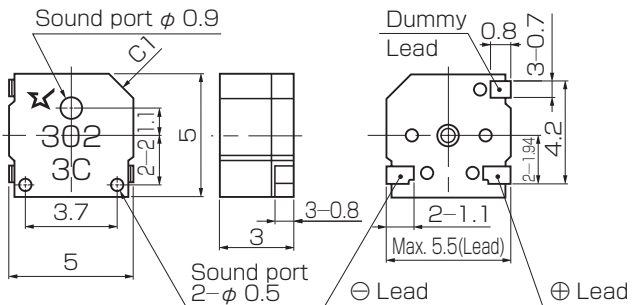
Specifications

Type	NFT-03C
Rated Voltage (V)	3.0
※ Mean Current Consumption (mA)	MAX100
Coil Resistance (Ω)	12±2
※ SPL at MIN10cm (dBA)	MIN78(TYP84)
Rated Frequency (Hz)	4,000
Operating Voltage (V)	MAX4.0
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.3

※Value applying rated voltage(4,000Hz, 1/2 duty, square wave)

Dimensions [size :5×5×3mm]

unit : mm./housing material : LCP



Non-washable

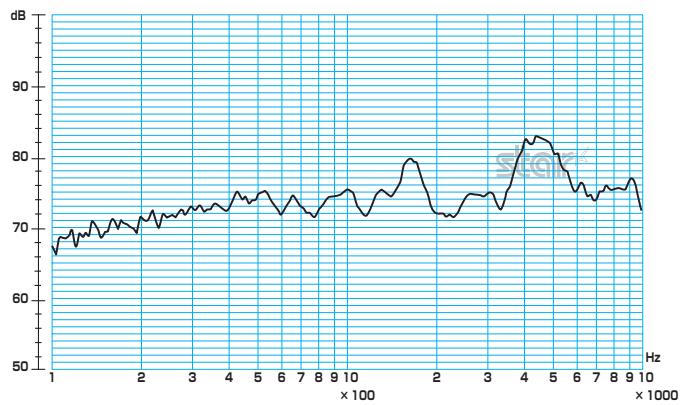
NFT series



NFT-03D

- Reflow
- Auto Mounting
- Upper Sound Port
- Patent
- Ultra Small

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty,
distance for measurement : 10cm with recommended cavity

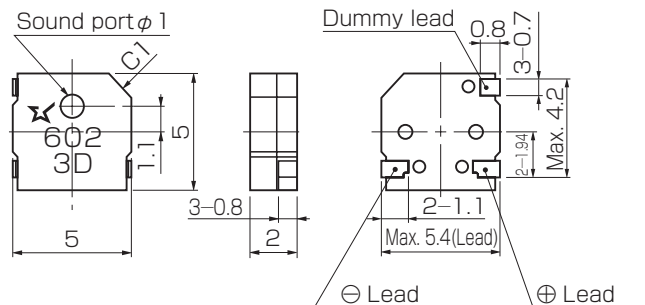
Specifications

Type	NFT-03D
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX110
Coil Resistance (Ω)	12±3
※ SPL at MIN10cm (dBA)	MIN78(TYP82)
Rated Frequency (Hz)	4,500
Operating Voltage (V)	MAX4.0
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.3

※Value applying rated voltage(4,500Hz, 1/2 duty, square wave)

Dimensions [size : 5×5×2mm]

unit : mm./housing material : LCP



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Non-washable

MLT-C series



MLT-03C

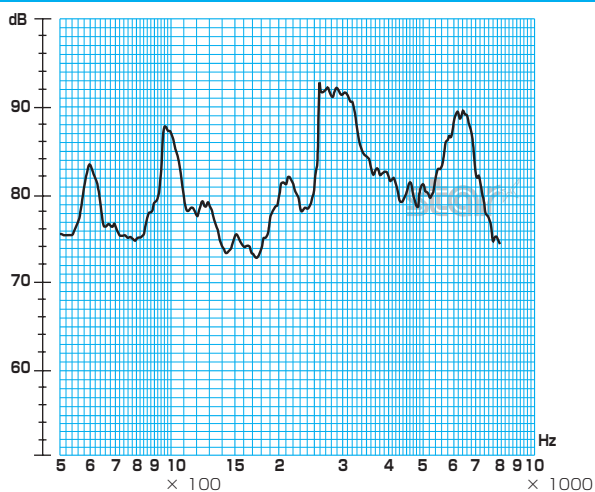
Reflow

Auto Mounting

Side Sound Port

Patent

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty,
distance for measurement : 10cm with recommended cavity

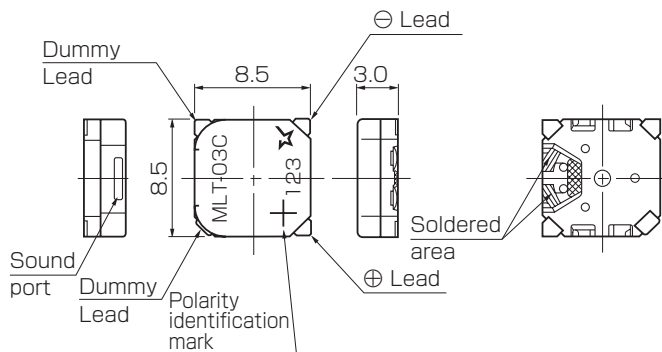
Specifications

Type	MLT-03C
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX100
Coil Resistance (Ω)	17±3
※ SPL at MIN10cm (dBA)	MIN88(TYP92)
Rated Frequency (Hz)	2,700
Operating Voltage (V)	MAX4.5
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.5

※Value applying rated voltage(2,670Hz, 1/2 duty, square wave)

Dimensions [size : 8.5×8.5×4mm]

unit : mm/housing material : LCP



Non-washable

MLT-G series



MLT-03GC

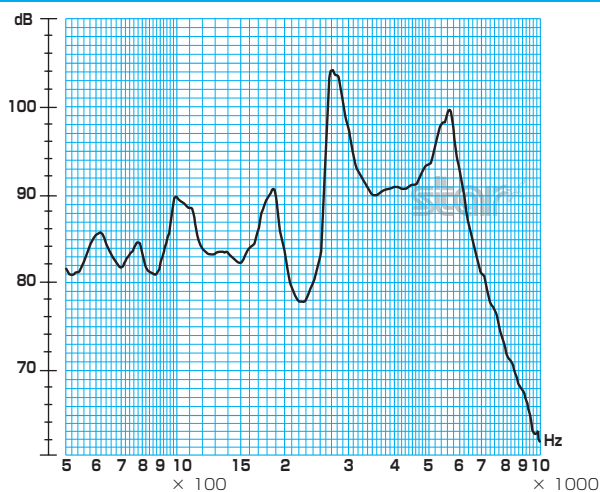
Reflow

Auto Mounting

Side Sound Port

Patent

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty,
distance for measurement : 10cm with recommended cavity

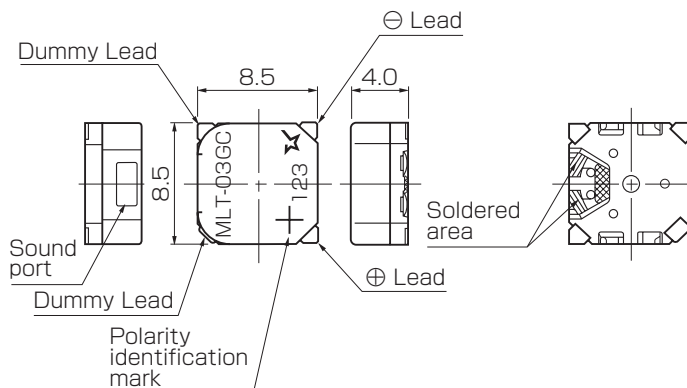
Specifications

Type	MLT-03GC
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX100
Coil Resistance (Ω)	17±3
※ SPL at MIN10cm (dBA)	MIN94(TYP103)
Rated Frequency (Hz)	2,700
Operating Voltage (V)	MAX4.5
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.5

※Value applying rated voltage(2,700Hz, 1/2 duty, square wave)

Dimensions [size : 8.5×8.5×4mm]

unit : mm/housing material : LCP



Non-washable

MLT-H series



MLT-03HH

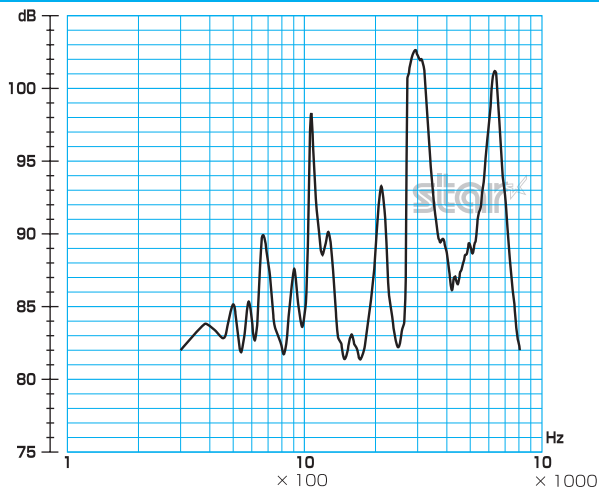
Reflow

Auto Mounting

Upper Sound Port

Patent

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty,
distance for measurement : 10cm with recommended cavity

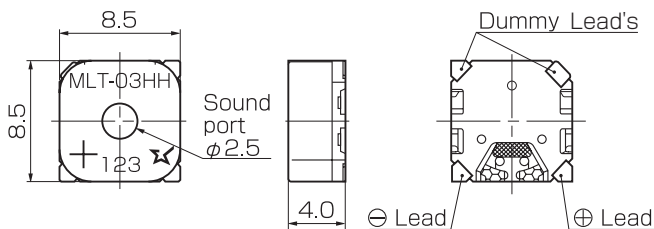
Specifications

Type	MLT-03HH
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX100
Coil Resistance (Ω)	17±3
※ SPL at MIN10cm (dBA)	MIN96(TYP102)
Rated Frequency (Hz)	3,000
Operating Voltage (V)	MAX4.5
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.5

※Value applying rated voltage(2,670Hz, 1/2 duty, square wave)

Dimensions [size : 8.5×8.5×4mm]

unit : mm/housing material : LCP



Non-washable

MZT-A series



MZT-03A-BLK

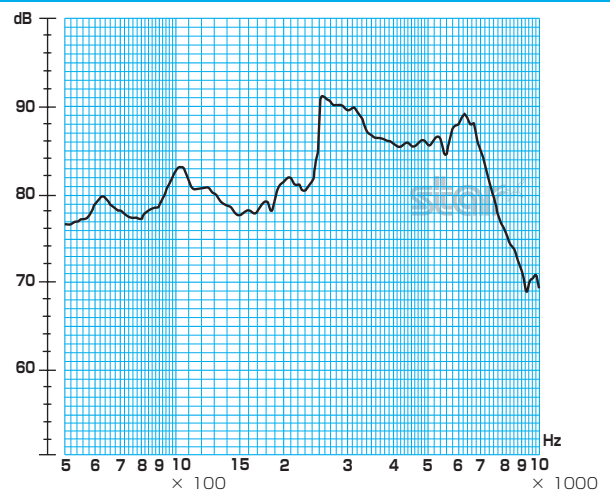
Reflow

Auto Mounting

Upper Sound Port

Patent

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty,
distance for measurement : 10cm

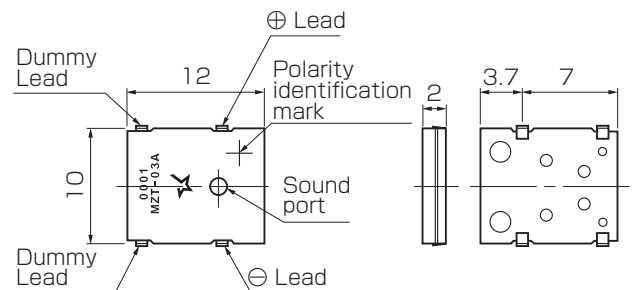
Specifications

Type	MZT-03A-BLK
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX70(TYP60)
Coil Resistance (Ω)	24±3
※ SPL at MIN10cm (dBA)	MIN83(TYP88)
Rated Frequency (Hz)	2,670
Operating Voltage (V)	MAX4.2
Operating Temperature (°C)	-30~+70
Storage Temperature (°C)	-40~+85
Mass (g)	0.5

※Value applying rated voltage(2,670Hz, 1/2 duty, square wave)

Dimensions [size : 10×12×2mm]

unit : mm/housing material : LCP



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

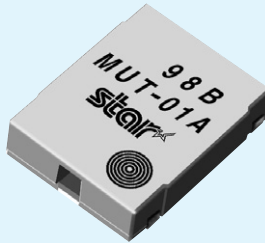
Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Non-washable

MUT series



MUT-01A

MUT-03A

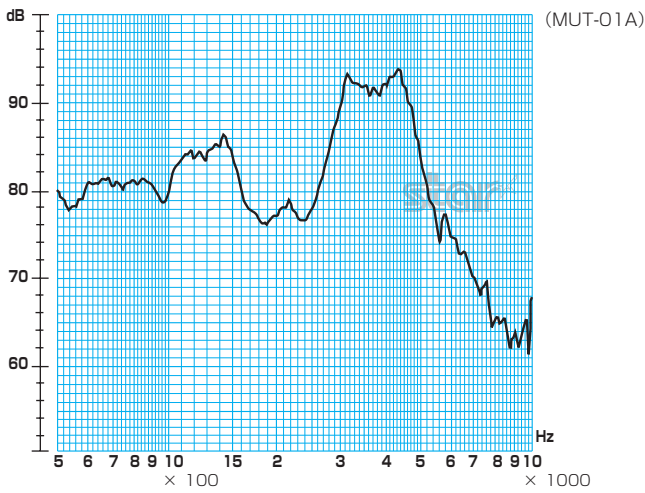
Reflow

Auto Mounting

Side Sound Port

Patent

Frequency Response



applied voltage : 1.5V, square wave : 1/2 duty,
distance for measurement : 10cm

Specifications

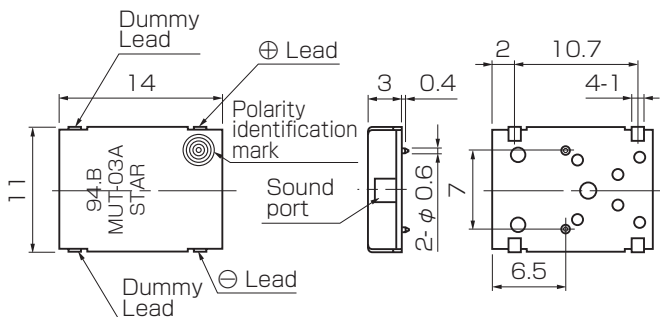
Type	MUT-01A	MUT-03A
Rated Voltage (V)	1.5	3
※ Mean Current Consumption (mA)	MAX65(TYP50)	MAX70(TYP56)
Coil Resistance (Ω)	9±2	18±3
※ SPL at MIN10cm (dBA)	MIN85(TYP92)	MIN87(TYP93)
Rated Frequency (Hz)	3,200	
Operating Voltage (V)	MAX1.7	MAX4.5
Operating Temperature (°C)	-20~+70	
Storage Temperature (°C)	-55~+85	
Mass (g)	1	

※Value applying rated voltage(3,200Hz, 1/2 duty, square wave)

Dimensions [size : 11 × 14 × 3mm]

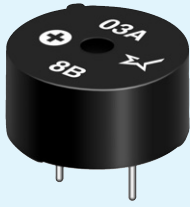
unit : mm / housing material : PA6T

(MUT-03A)



Non-washable

QCP series

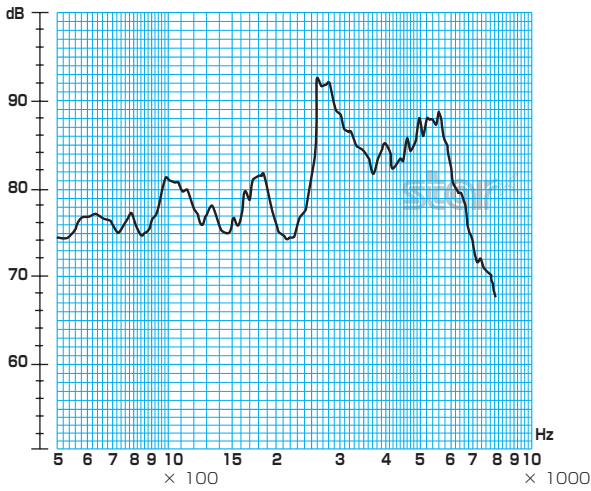


QCP-03A

Upper Sound Port

Patent

Frequency Response



applied voltage : 3.6V, square wave : 1/2 duty, distance for measurement : 10cm

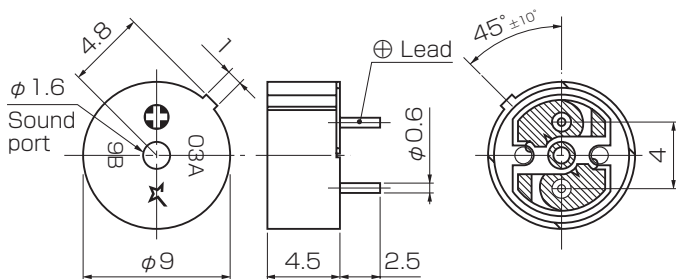
Specifications

Type	QCP-03A
Rated Voltage (V)	3.6
※ Mean Current Consumption (mA)	MAX90(TYP81)
Coil Resistance (Ω)	16±3
※ SPL at MIN10cm (dBA)	MIN85(TYP90)
Rated Frequency (Hz)	2,670
Operating Voltage (V)	MAX4.3
Operating Temperature (°C)	-30~+60
Storage Temperature (°C)	-30~+70
Mass (g)	1

※ Value applying rated voltage(2,670Hz, 1/2 duty, square wave)

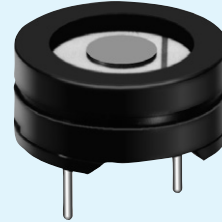
Dimensions [size : φ9×4.5mm]

unit : mm/housing material : PPE-M/PA(QCL-03A), PA66(QCP-03A)



Non-washable

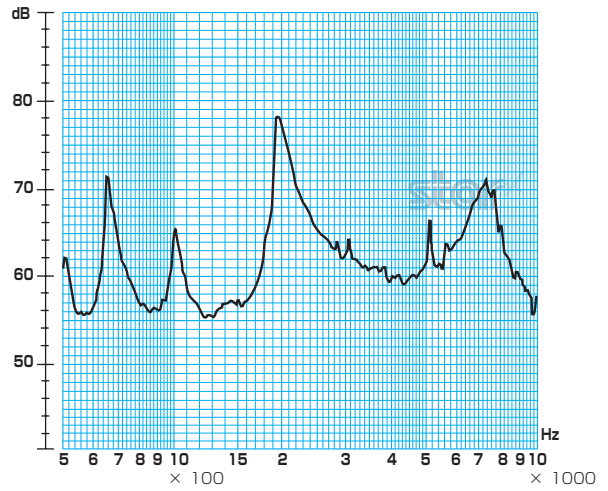
QMB-105 series



QMB-105P

Upper Sound Port

Frequency Response



applied voltage : 1.5V, square wave : 1/2 duty, distance for measurement : 10cm

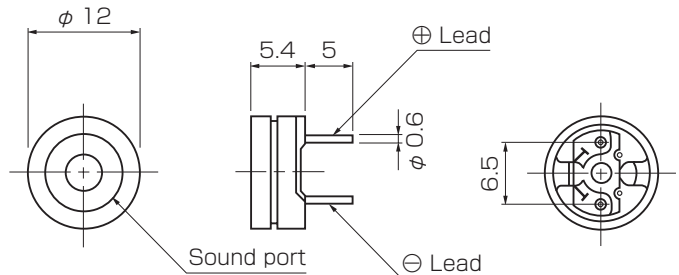
Specifications

Type	QMB-105P
Rated Voltage (V)	1.5
※ Mean Current Consumption (mA)	MAX10(TYP9.1)
Coil Resistance (Ω)	50±7.5
※ SPL at MIN10cm (dBA)	MIN70(TYP77)
Rated Frequency (Hz)	2,048
Operating Voltage (V)	MAX2
Operating Temperature (°C)	-20~+60
Storage Temperature (°C)	-30~+70
Mass (g)	2

※ Value applying rated voltage(2,048Hz, 1/2 duty, square wave)

Dimensions [size : φ 12×5.4mm]

unit : mm/housing material : PPE-M



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

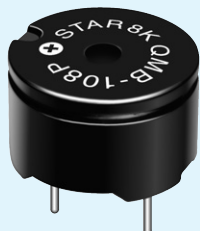
Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Non-washable

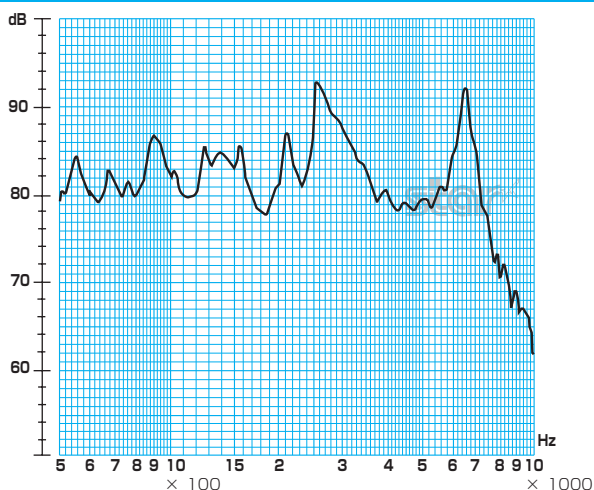
QMB-108 series



QMB-108P

Upper Sound Port

Frequency Response



applied voltage : 1.5V, square wave : 1/2 duty, distance for measurement : 10cm

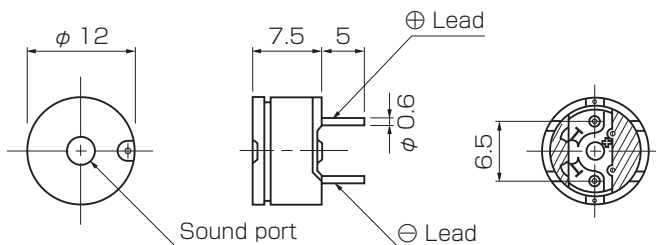
Specifications

Type	QMB-108P
Rated Voltage (V)	1.5
※ Mean Current Consumption (mA)	MAX60(TYP51)
Coil Resistance (Ω)	6.5±1
※ SPL at MIN10cm (dBA)	MIN85(TYP90)
Rated Frequency (Hz)	2,743
Operating Voltage (V)	MAX2
Operating Temperature (°C)	-20~+60
Storage Temperature (°C)	-30~+70
Mass (g)	1.6

※Value applying rated voltage(2,743Hz, 1/2 duty, square wave)

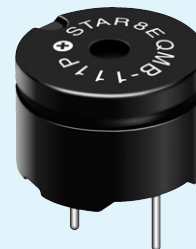
Dimensions [size : φ 12×7.5mm]

unit : mm/housing material : PPE-M



Non-washable

QMB-111 series



QMB-111PN

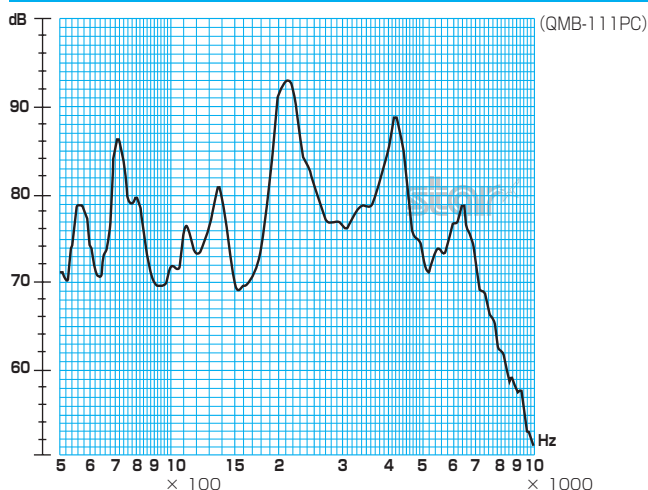
QMB-111GPN

QMB-111PC

Upper Sound Port

Patent

Frequency Response



applied voltage : 5V, square wave : 1/2 duty, distance for measurement : 10cm

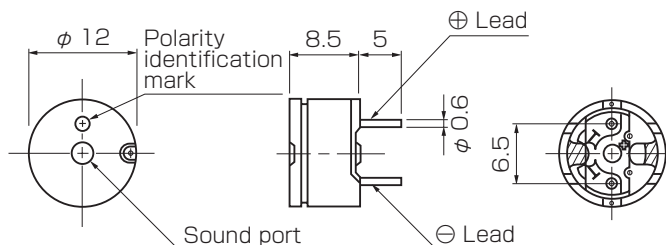
Specifications

Type	QMB-111PN	QMB-111GPN	QMB-111PC
Rated Voltage (V)	1.5		5
※ Mean Current Consumption (mA)	MAX10(TYP8.3)	MAX35(TYP26)	MAX40(TYP31)
Coil Resistance (Ω)	50±7.5	16±4.5	50±7.5
※ SPL at MIN10cm (dBA)	MIN80(TYP87)	MIN85(TYP91)	MIN85(TYP92)
Rated Frequency (Hz)		2,048	2,000
Operating Voltage (V)		MAX2	MAX5
Operating Temperature (°C)		-20~+60	
Storage Temperature (°C)		-30~+70	
Mass (g)		2	

※Value applying rated voltage(rated frequency, 1/2 duty, square wave)

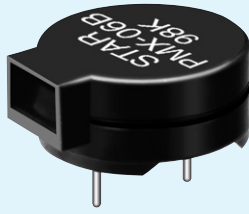
Dimensions [size : φ 12×8.5mm]

unit : mm/housing material : PPE-M



Non-washable

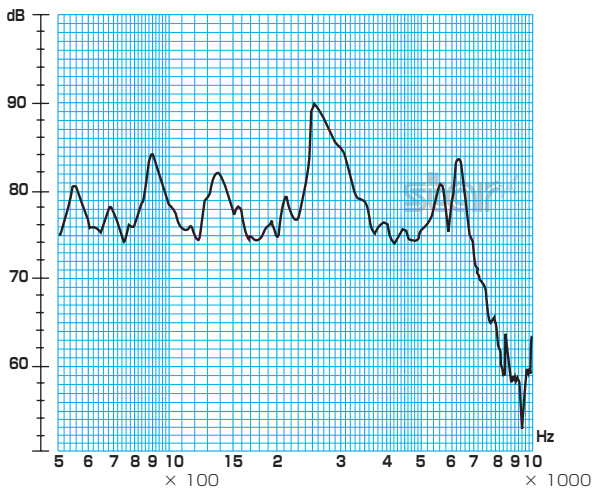
PMX-06 series



PMX-06B

Side Sound Port

Frequency Response



applied voltage : 1.5V, square wave : 1/2 duty,
distance for measurement : 10cm

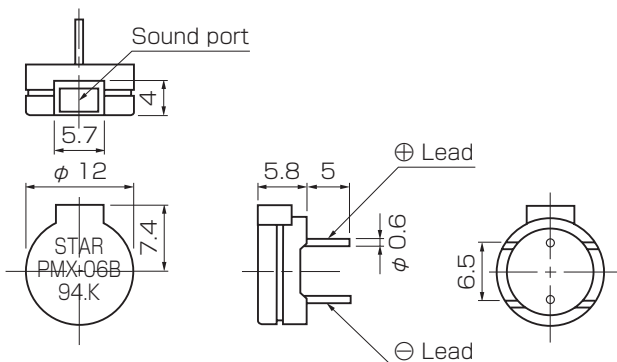
Specifications

Type	PMX-06B
Rated Voltage (V)	1.5
※ Mean Current Consumption (mA)	MAX70(TYP50)
Coil Resistance (Ω)	6.5±1
※ SPL at MIN10cm (dBA)	MIN83(TYP88)
Rated Frequency (Hz)	2,731
Operating Voltage (V)	MAX2
Operating Temperature (°C)	-20~+60
Storage Temperature (°C)	-30~+70
Mass (g)	2

※ Value applying rated voltage(2,731Hz, 1/2 duty, square wave)

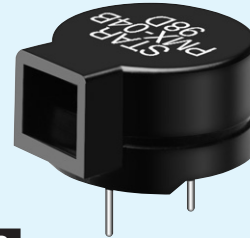
Dimensions [size : φ 12×5.8mm]

unit : mm./housing material : PPE-M



Non-washable

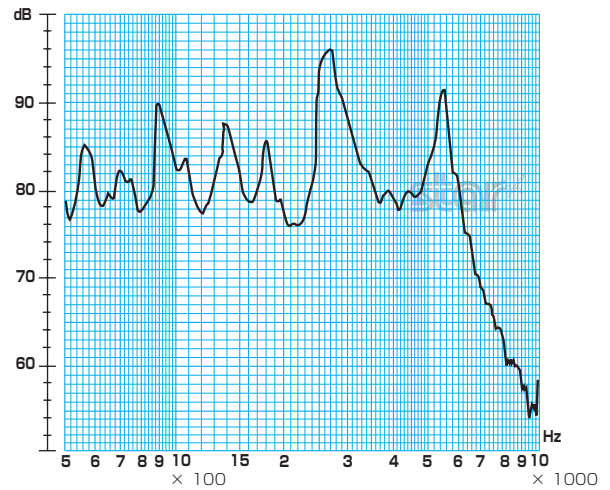
PMX-04B series



PMX-04B

Side Sound Port

Frequency Response



applied voltage : 1.5V, square wave : 1/2 duty,
distance for measurement : 10cm

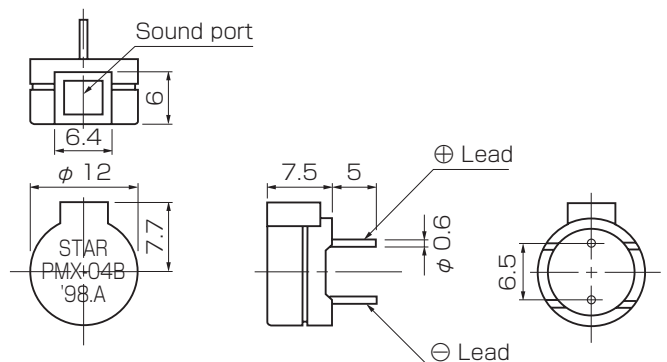
Specifications

Type	PMX-04B
Rated Voltage (V)	1.5
※ Mean Current Consumption (mA)	MAX70(TYP51)
Coil Resistance (Ω)	6.5±1
※ SPL at MIN10cm (dBA)	MIN85(TYP92)
Rated Frequency (Hz)	2,731
Operating Voltage (V)	MAX2
Operating Temperature (°C)	-20~+60
Storage Temperature (°C)	-30~+70
Mass (g)	2

※ Value applying rated voltage(2,731Hz, 1/2 duty, square wave)

Dimensions [size : φ 12×7.5mm]

unit : mm./housing material : PPE-M



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Washable

QMX series



QMX-05

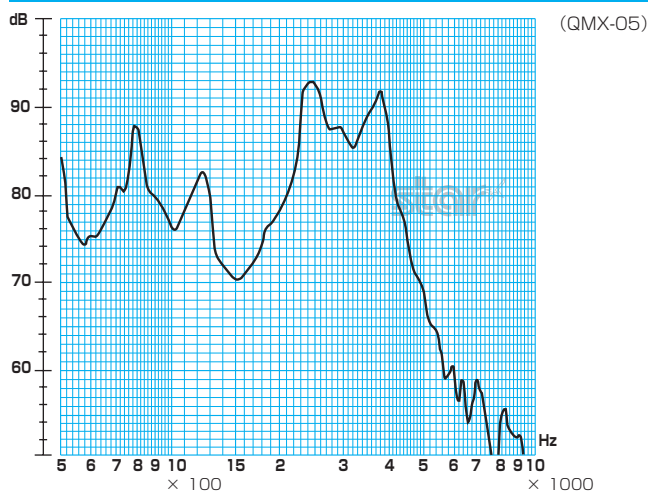
QMX-12

Dip

Wide Frequency

Upper Sound Port

Frequency Response



applied voltage : 5V, square wave : 1/2 duty,
distance for measurement : 10cm

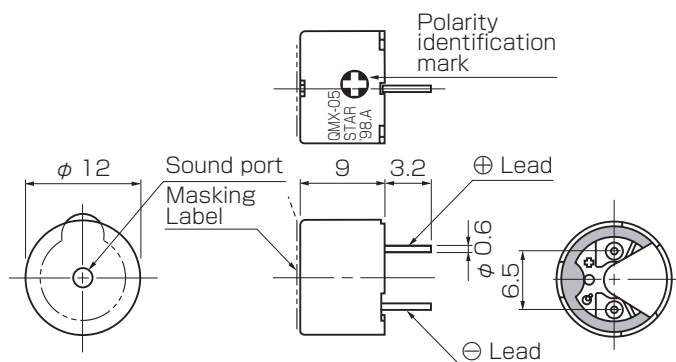
Specifications

Type	QMX-05	QMX-12
Rated Voltage (V)	5	12
※ Mean Current Consumption (mA)	MAX40(TYP33)	MAX40(TYP28)
Coil Resistance (Ω)	47±5	140±14
※ SPL at MIN10cm (dBA)	MIN85(TYP92)	
Rated Frequency (Hz)	2,400	
Operating Voltage (V)	MAX8	MAX15
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	2	

※Value applying rated voltage(2,400Hz, 1/2 duty, square wave)

Dimensions [size : φ 12×9mm]

unit : mm/housing material : PPE-M



Washable

HGP series



HGP-05AM

HGP-12AM

Dip

Wide Frequency

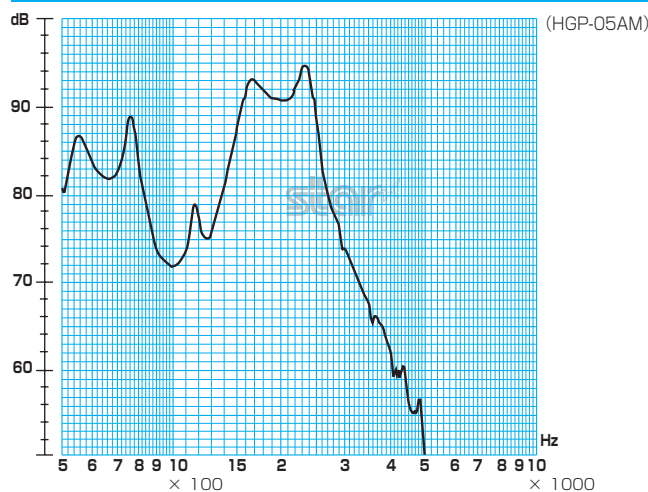
Low Frequency

Case Color : blue

Patent

Upper Sound Port

Frequency Response



applied voltage : 5V, square wave : 1/2 duty,
distance for measurement : 10cm

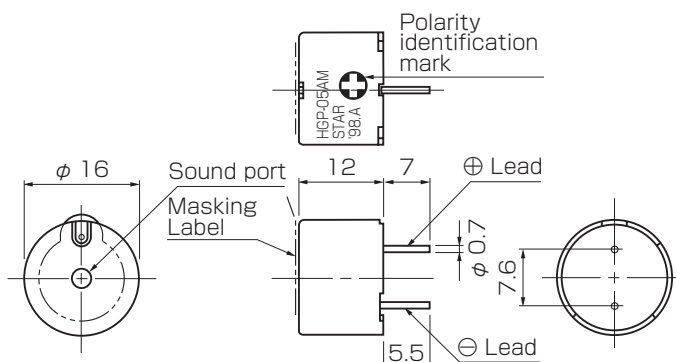
Specifications

Type	HGP-05AM	HGP-12AM
Rated Voltage (V)	5	12
※ Mean Current Consumption (mA)	MAX70(TYP55)	MAX50(TYP30)
Coil Resistance (Ω)	28±6	135±20
※ SPL at MIN10cm (dBA)	MIN85(TYP90)	MIN85(TYP91)
Frequency Band (Hz)	1,700~2,200	
Operating Voltage (V)	MAX8	MAX15
Operating Temperature (°C)	-40~+90	
Storage Temperature (°C)	-40~+100	
Mass (g)	4	

※Value applying rated voltage(2,000Hz, 1/2 duty, square wave)

Dimensions [size : φ 16×12mm]

unit : mm/housing material : PPE-M



Washable

RMX series



RMX-06

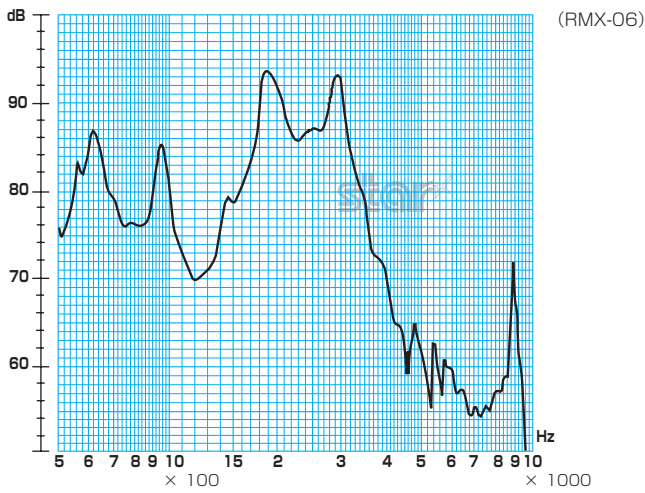
RMX-12Y

Dip

Wide Frequency

Upper Sound Port

Frequency Response



applied voltage : 6V, square wave : 1/2 duty,
distance for measurement : 10cm

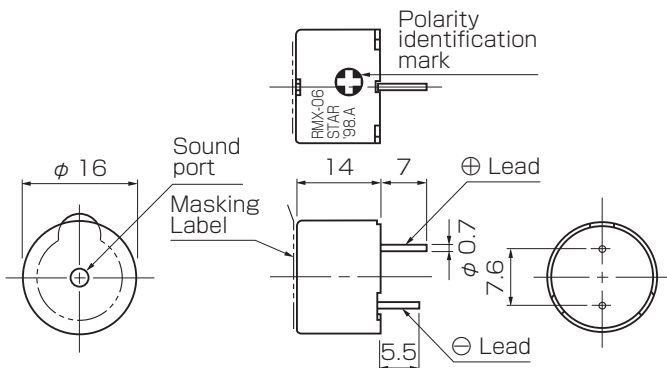
Specifications

Type	RMX-06	RMX-12Y
Rated Voltage (V)	6	12
※ Mean Current Consumption (mA)	MAX40(TYP33)	MAX40(TYP32)
Coil Resistance (Ω)	45±7	115±17
※ SPL at MIN10cm (dBA)	MIN85(TYP93)	MIN85(TYP96)
Frequency Band (Hz)	2,048	
Reproduced Frequency (Hz)	2,000~3,000	
Operating Voltage (V)	MAX12	MAX18
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	5	

※ Value applying rated voltage(2,048Hz, 1/2 duty, square wave)

Dimensions [size : φ 16×14mm]

unit : mm/housing material : PBT



Washable

QMB series



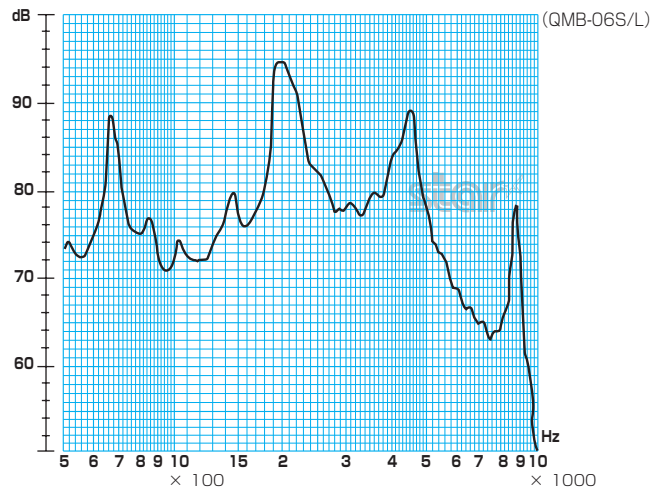
QMB-06S/L

QMB-12S/L

Dip

Upper Sound Port

Frequency Response



applied voltage : 6V, square wave : 1/2 duty,
distance for measurement : 10cm

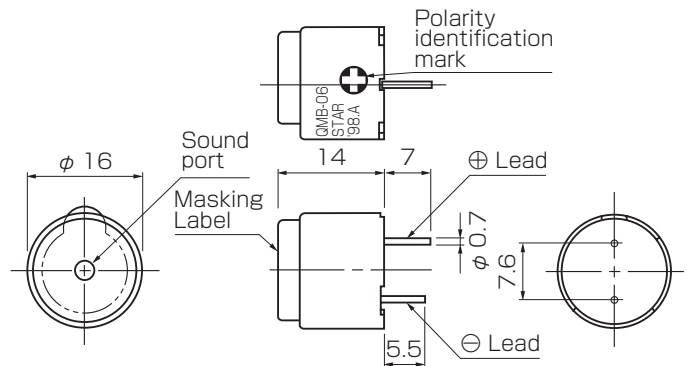
Specifications

Type	QMB-06S/L	QMB-12S/L
Rated Voltage (V)	6	12
※ Mean Current Consumption (mA)	MAX40(TYP35)	MAX40(TYP32)
Coil Resistance (Ω)	47±7	115±17
※ SPL at MIN10cm (dBA)	MIN85(TYP94)	MIN85(TYP97)
Rated Frequency (Hz)	2,048	
Operating Voltage (V)	MAX12	MAX18
Operating Temperature (°C)	-40~+100	
Storage Temperature (°C)	-40~+100	
Mass (g)	7	

※ Value applying rated voltage(2,048Hz, 1/2 duty, square wave)

Dimensions [size : φ 16×14mm]

unit : mm/housing material : PPE-M



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Magnetic Sounder
 Reflow type
 Non-washable type
 Washable type
 Magnetic Buzzer
 Electric Sound type (Washable)
 Vibrating Hammer type (Non-washable)
 Dynamic Speaker (Non-washable)
 Technical data

Washable

TMX-F

series

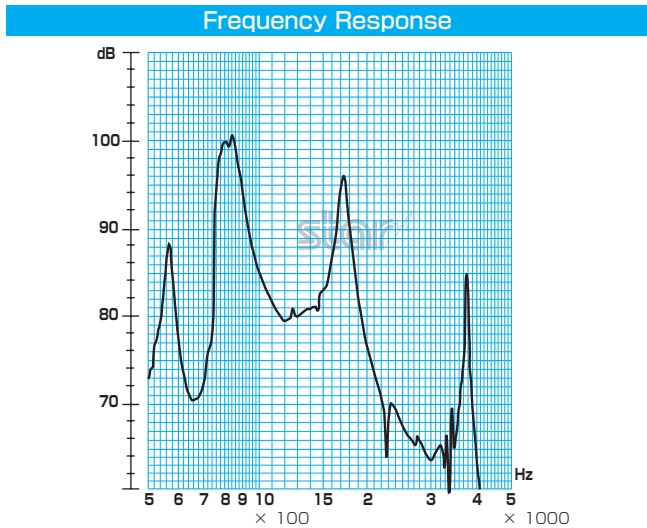


TMX-12F

※) Please request label type if you need washable.

Dip
High SPL
Patent
Low Frequency

Upper Sound Port



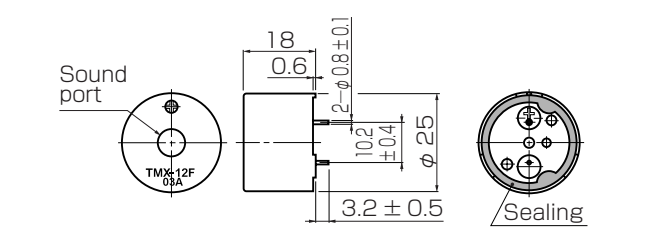
applied voltage : 12V, square wave : 1/2 duty,
 distance for measurement : 10cm

Specifications	
Type	TMX-12F
Rated Voltage (V)	12
※ Mean Current Consumption (mA)	MAX40
Coil Resistance (Ω)	180±25
※ SPL at MIN10cm (dBA)	MIN95(TYP99)
Rated Frequency (Hz)	850
Operating Voltage (V)	MAX16
Operating Temperature (°C)	-40~+85
Storage Temperature (°C)	-40~+120
Mass (g)	9

※Value applying rated voltage(850Hz, 1/2 duty, square wave)

Dimensions [size : φ25×18mm]

unit : mm/housing material : PPE-M



Washable

TMX-H

series

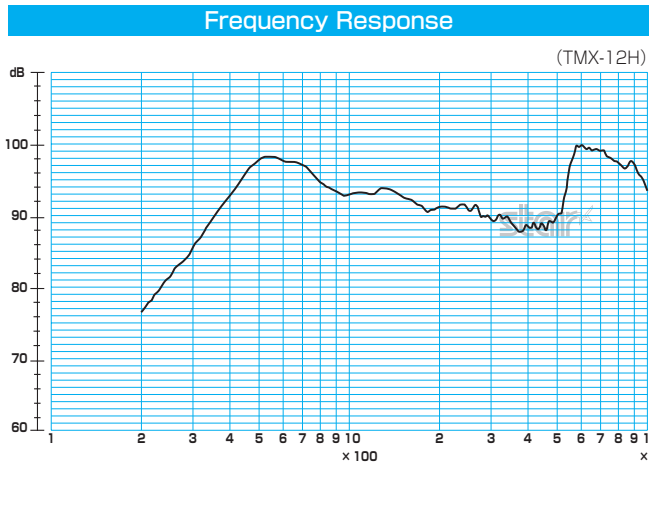


TMX-05H **TMX-12H**

※) Please request label type if you need washable.

Dip
High SPL
Patent
Low Frequency

Upper Sound Port



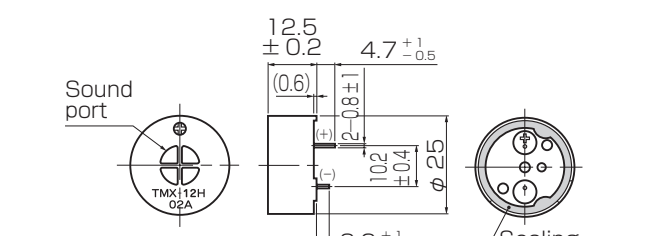
applied voltage : 12V, square wave : 1/2 duty,
 distance for measurement : 10cm

Specifications		
Type	TMX-05H	TMX-12H
Rated Voltage (V)	5	12
※ Mean Current Consumption (mA)	MAX80	MAX55
Coil Resistance (Ω)	30±5	120±15
※ SPL at MIN10cm (dBA)	MIN104(TYP110)	
Rated Frequency (Hz)	1,500	
Operating Voltage (V)	MAX6	MAX16
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+120	
Mass (g)	9	

※Value applying rated voltage(1,500Hz, 1/2 duty, square wave)

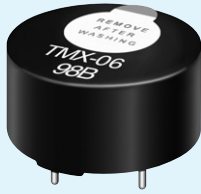
Dimensions [size : φ25×12.5mm]

unit : mm/housing material : PPE-M (TMX-12H)



Washable

TMX-S3 series



TMX-06S3

TMX-12S3

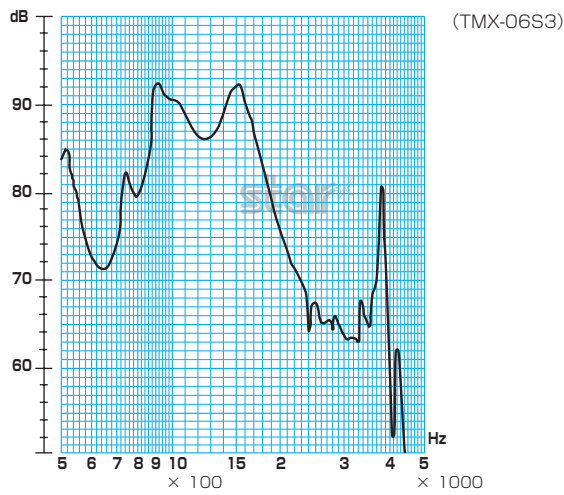
Dip

Low Frequency

Patent

Upper Sound Port

Frequency Response



applied voltage : 6V, square wave : 1/2 duty,
distance for measurement : 10cm

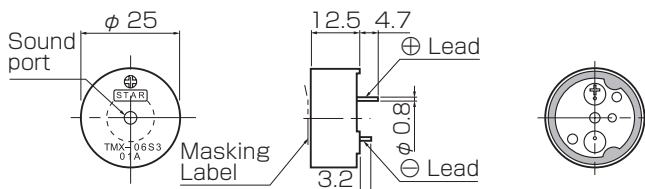
Specifications

Type	TMX-06S3	TMX-12S3
Rated Voltage (V)	6	12
※ Mean Current Consumption (mA)	MAX75	MAX55
Coil Resistance (Ω)	36±5	120±15
※ SPL at MIN10cm (dBA)	MIN85(TYP90)	
Rated Frequency (Hz)	1,000	
Operating Voltage (V)	MAX8	MAX14
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	9	

※ Value applying rated voltage(1,000Hz, 1/2 duty, square wave)

Dimensions [size : φ25×12.5mm]

unit : mm./housing material : PPE-M



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

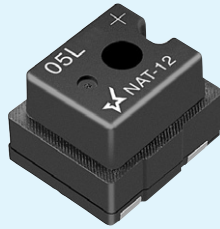
Dynamic Speaker (Non-washable)

Technical data

Non-washable

NAT series

Reflow type buzzer for Automotive



NAT-05A

NAT-12V

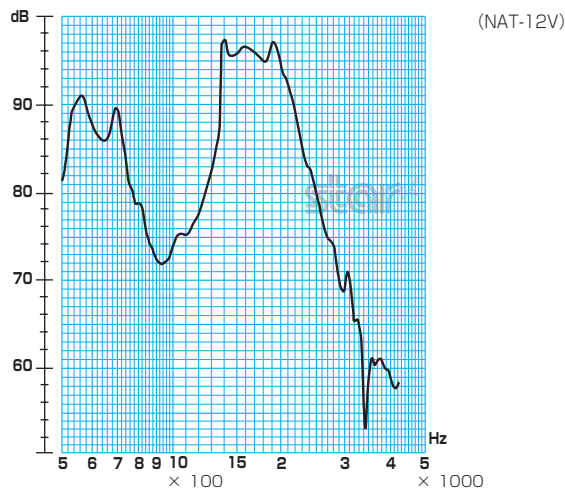
Reflow

Auto Mounting

Upper Sound Port

Patent

Frequency Response



(NAT-12V)

applied voltage : 12V, square wave : 1/2 duty,
distance for measurement : 10cm

Specifications

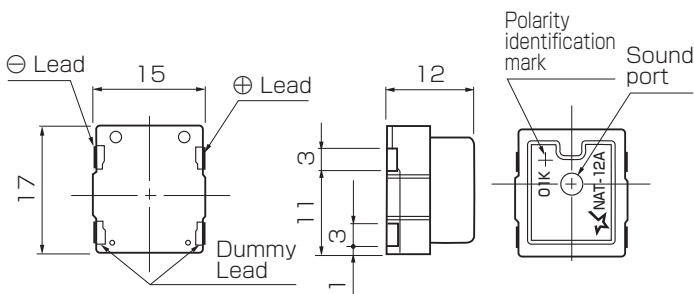
Type	NAT-05A	NAT-12V
Rated Voltage (V)	5	12
※ Mean Current Consumption (mA)	MAX80	MAX55
Coil Resistance (Ω)	30±5	120±10
※ SPL at MIN10cm (dBA)	MIN88(TYP95)	MIN88(TYP95)
Rated Frequency (Hz)	2,000	
Frequency Band (Hz)	1,700~2,300	
Operating Voltage (V)	MAX7	MAX16
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	3	

※Value applying rated voltage(①600Hz ②2000Hz, 1/2 duty, square wave)

Dimensions [size : 15×17×12mm]

unit : mm/housing material : PA6T

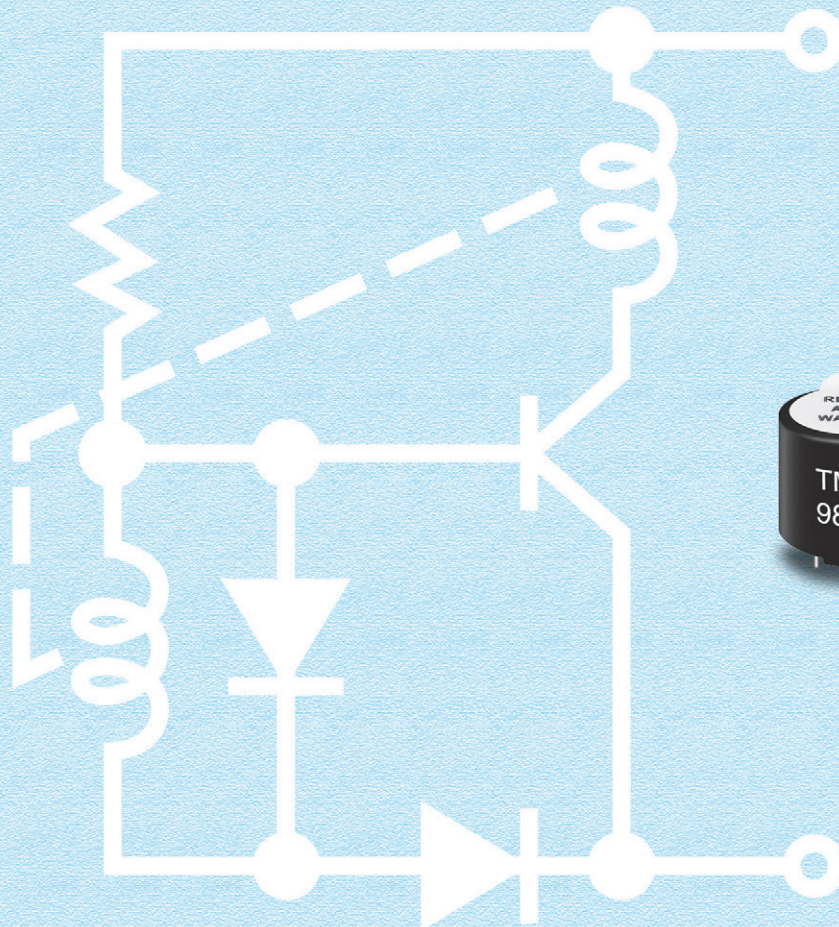
(NAT-12A)



Magnetic Buzzer

(Self-contained drive circuitry)

Electric Sound type



Magnetic Sounder
Reflow type
Non-washable type
Washable type
Magnetic Buzzer
Electric Sound type (Washable)
Vibrating Hammer type (Non-washable)
Dynamic Speaker (Non-washable)
Technical data

Electric Sound type (Washable)

TMB series



TMB-05

TMB-12

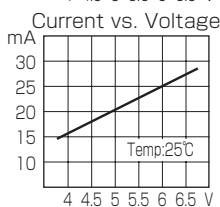
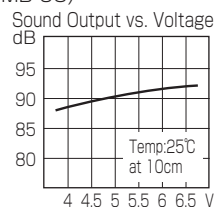
Dip

Low Consumption

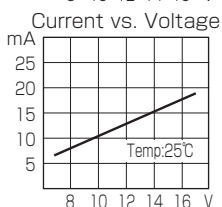
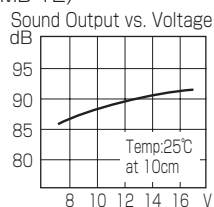
Upper Sound Port

Characteristics

(TMB-05)



(TMB-12)



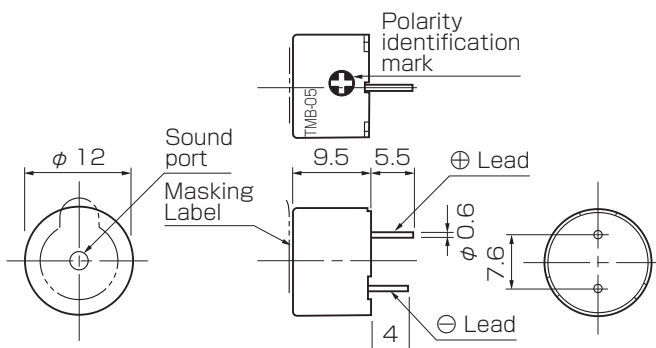
Specifications

Type	TMB-05	TMB-12
Rated Voltage (V)	5	12
Operating Voltage (V)	4~6.5	8~16
※ Mean Current Consumption (mA)	MAX30(TYP22)	MAX30(TYP15)
※ SPL at MIN10cm(dBA)	MIN85(TYP90)	
※ Basic Frequency (Hz)	2,300±300	
☆ Response Time (msec)	MAX50	
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	2	

※Value applying rated voltage ☆Value applying min. operating voltage

Dimensions [size : φ 12×9.5mm]

unit : mm/housing material : PPE-M (※)Longer pin is (+) polarity



Electric Sound type (Washable)

HMB series



HMB-06

HMB-12

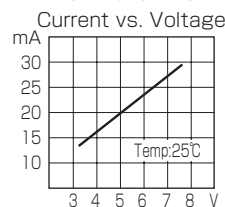
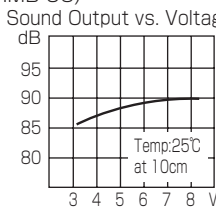
Dip

Low Consumption

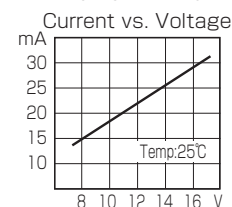
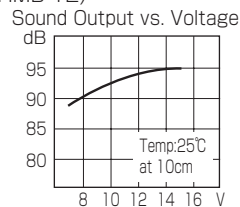
Upper Sound Port

Characteristics

(HMB-06)



(HMB-12)



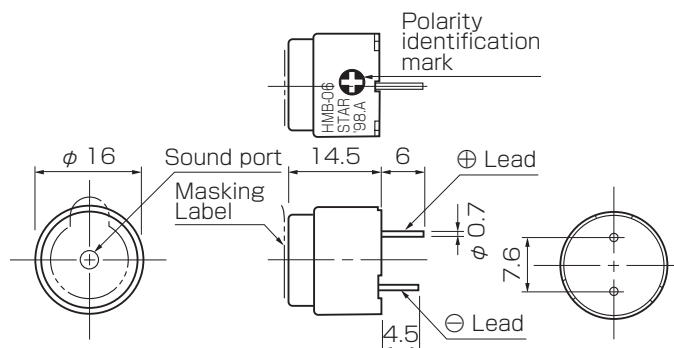
Specifications

Type	HMB-06	HMB-12
Rated Voltage (V)	6	12
Operating Voltage (V)	4~7	8~16
※ Mean Current Consumption (mA)	MAX30(TYP27)	MAX30(TYP25)
※ SPL at MIN10cm(dBA)	MAX85(TYP90)	MAX85(TYP91)
※ Basic Frequency (Hz)	2,200±300	
☆ Response Time (msec)	MAX50	
Operating Temperature (°C)	-40~+85	
Storage Temperature (°C)	-40~+85	
Mass (g)	5	

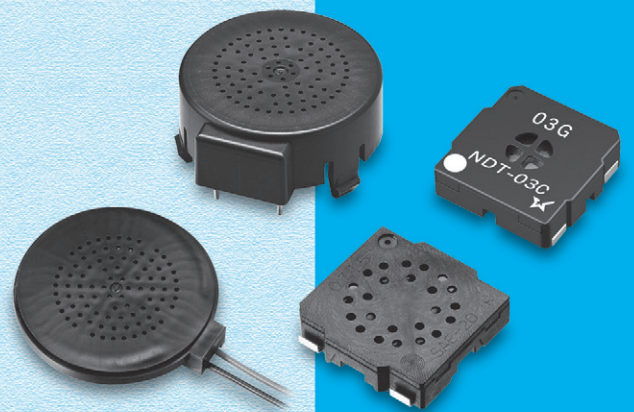
※Value applying rated voltage ☆Value applying min. operating voltage

Dimensions [size : φ 16×14.5mm]

unit : mm/housing material : PPE-M (※)Longer pin is (+) polarity



Dynamic Speaker



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

Dynamic Speaker (Non-washable)

SAC-C series

Speaker for Automotive



SAC-30C

Heat Resistant

Patent

Square/Sine Wave Drive

Dynamic Speaker (Non-washable)

SAC-D series

Speaker for Automotive



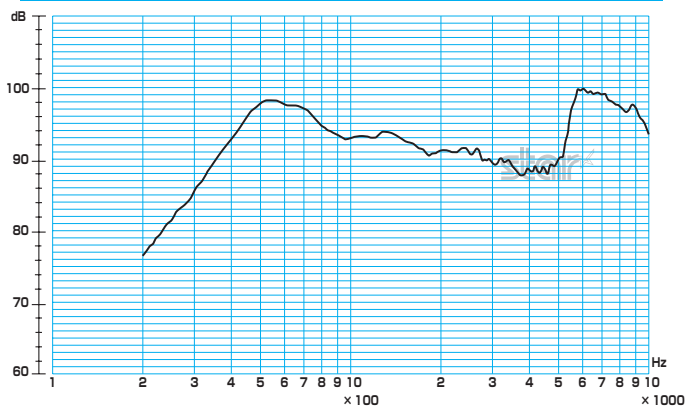
SAC-30D

Heat Resistant

Patent

Square/Sine Wave Drive

Frequency Response



(Sine wave)

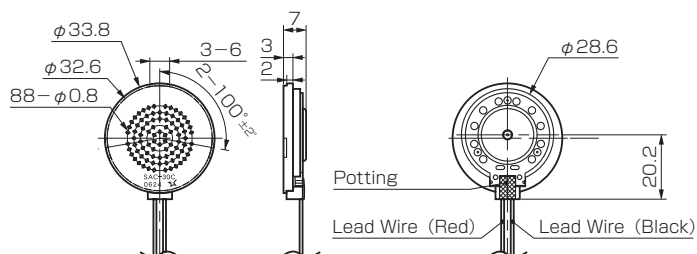
Specifications

Type	SAC-30C	
Nominal Input (W)	0.2	
Max Input (W)	0.4	
Impedance (Ω)	8 \pm 2	
Resonance Frequency (Hz)	—	
※ SPL at MIN10cm (dBA)	92	
Operating Temperature ($^{\circ}$ C)	-40~+105	
Preservation Temperature ($^{\circ}$ C)	-40~+120	
Mass (g)	8.3	

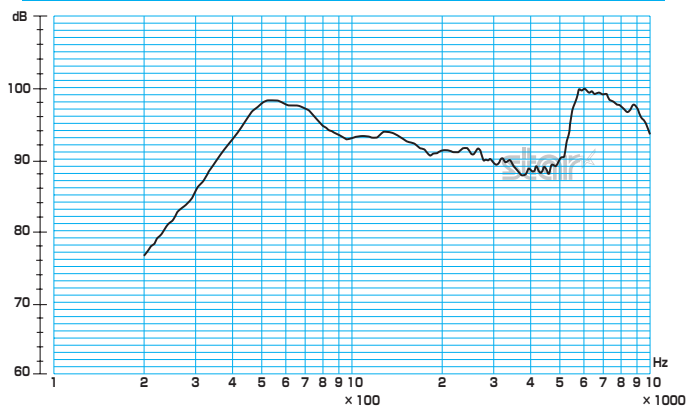
※Value applying rated power(sine wave)

Dimensions [size : ϕ 33.8 \times 7mm]

unit : mm/housing material : PP



Frequency Response



(Sine wave)

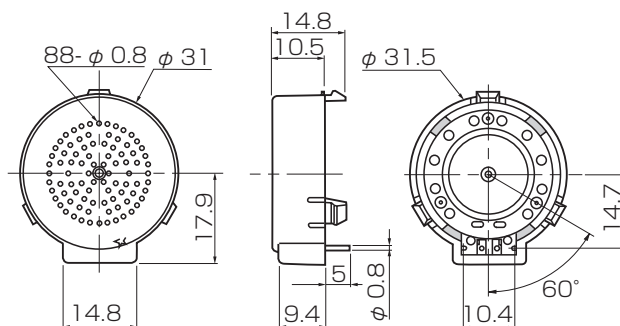
Specifications

Type	SAC-30D-8	
Nominal Input (W)	0.2	
Max Input (W)	0.4	
Impedance (Ω)	8 \pm 2	
Resonance Frequency (Hz)	—	
※ SPL at MIN10cm (dBA)	92	
Operating Temperature ($^{\circ}$ C)	-40~+105	
Preservation Temperature ($^{\circ}$ C)	-40~+120	
Mass (g)	8.3	

※Value applying rated power(sine wave)

Dimensions [size : ϕ 31.5 \times 14.8mm]

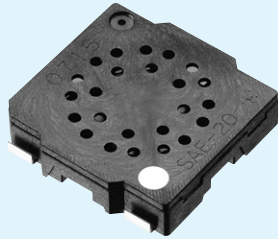
unit : mm/housing material : PP



Dynamic Speaker (Non-washable)

SAE series

Speaker for Automotive



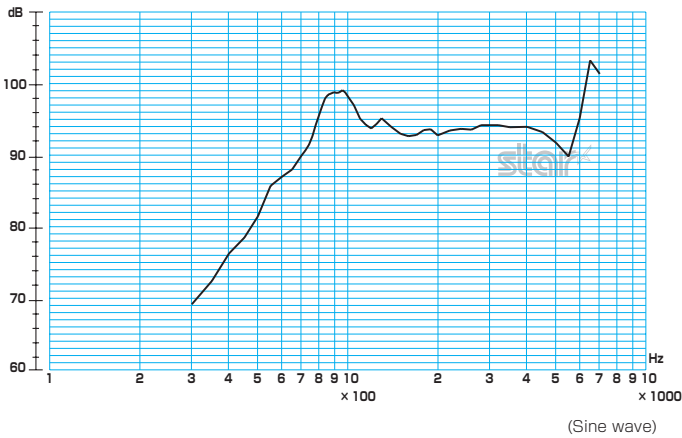
SAE-20A

Heat Resistant

Patent

Square/Sine Wave Drive

Frequency Response



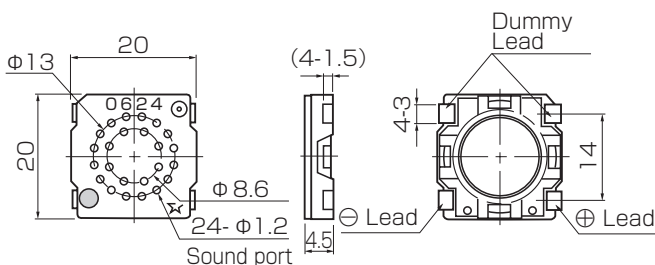
Specifications

Type	SAE-20A	
Nominal Input (W)	0.5	
Max Input (W)	0.8	
Impedance (Ω)	8±1.6	
Resonance Frequency (Hz)	850±100	
※ SPL at MIN10cm (dBA)	95±3 at 800Hz	
Operating Temperature (°C)	-40~+85	
Preservation Temperature (°C)	-40~+105	
Mass (g)	3.0	

※Value applying rated power(sine wave)

Dimensions [size : 20×20×4.5mm]

unit : mm/housing material : LCP



Dynamic Speaker (Non-washable)

NDT series

Speaker for Automotive



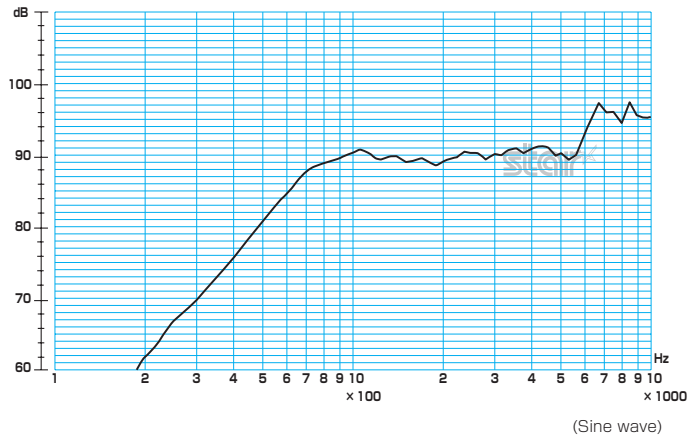
NDT-03C

Heat Resistant

Patent

Square/Sine Wave Drive

Frequency Response



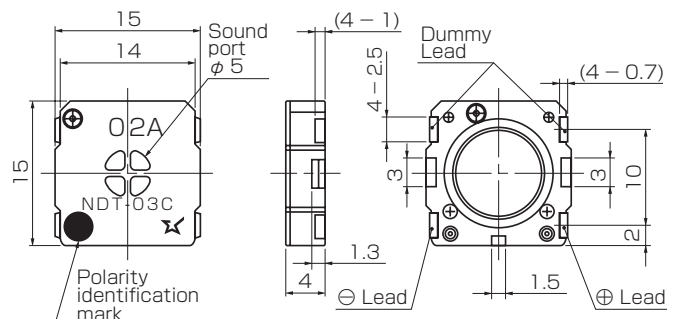
Specifications

Type	NDT-03C	
Nominal Input (W)	0.5	
Max Input (W)	0.8	
Impedance (Ω)	8±1.6	
Resonance Frequency (Hz)	800±100	
※ SPL at MIN10cm (dBA)	90±3	
Operating Temperature (°C)	-30~+85	
Preservation Temperature (°C)	-40~+105	
Mass (g)	1.6	

※Value applying rated power(sine wave)

Dimensions [size : 15×15×4mm]

unit : mm/housing material : PA6T



Technical Data

■ Technical data

- **Magnetic Sounder**
- **Magnetic Buzzer**
- **Supplemental Information on Speaker Handling**
- **Sound Pressure and Tone**
- **Soldering · Support Service**

MAGNETIC SOUNDER

Various Types of Magnetic Sounder Buzzers

Acoustic components generally referred to as buzzers can be classified as ① magnetic sounders, ② electric sound type buzzers, ③ vibrating hammer type buzzers, ④ piezoelectric buzzers, and ⑤ piezoelectric sounders. Star Micronics produces ①, ②, and ③ in our product line. A sounder issues sound by inputting specific electric signals from outside. Therefore, it is necessary to provide an oscillating circuit when utilizing a sounder. A buzzer (electric sound type buzzers, vibrating hammer type buzzers), meanwhile, incorporates a sounder and an oscillating circuit within, so it produces sound only when direct current is applied to it.

Structure and Operating Principle of Magnetic Sounders

The structure of a magnetic sounder is shown in Fig. 1. The operating principle of a magnetic sounder is herein described, based on this figure. The magnetic flux from a magnet produces a bias magnetic field at the tip of the iron core, drawing a diaphragm toward itself by a suitable force. If electric signals (for example, rectangular-shaped voltage with a frequency of 3.2 KHz and 1.5 Vo-p) coming intermittently at a fixed frequency from an external oscillating circuit are input, an electric current will intermittently flow through the coil, generating an intermittent magnetic field at the tip of the iron core.

The magnetic field drives the diaphragm up and down, generating the sound pressure corresponding to the amplitude of the diaphragm. This sound pressure is further multiplied by the resonance effect of the resonator installed on the case. Each product is designed and adjusted based on resonance frequency (fo) and resonance frequency (fv), so that excellent performance is obtained at the standard frequency. Accordingly, the functional composition of a magnetic sounder can be divided into the magnetic circuit unit, and the resonance unit. (Fig. 1)

Characteristics

Measuring Circuit

We at Star Micronics input electric signals of a specific frequency to a magnetic sounder, using the measuring circuit shown in Fig. 2, to measure the characteristics of the sounder. Please use this information in measuring your sounders and arranging driving circuits. (Fig. 2)

Frequency Characteristics

A magnetic sounder emits sound based on the frequency of the electric signals input, and it is the frequency characteristics that determine what degree of sound is caused in relation to input frequency. Frequency characteristics are generally shown as a graph that indicates results of measurement at the sound pressure level (SPL) 10 cm in front of the magnetic sounder, while changing the frequency of input signals from 500 Hz to 10 KHz at the rated voltage. They are referred to as sound pressure level frequency characteristics.

In this catalog, the representative value of the frequency characteristics for each product is shown for reference. Use these values for product selection to match the purpose and input conditions for use, while noting their difference. Frequency characteristics shown in the catalog are those at a time when rectangular waves (Vo-p) are input. When input is in the form of rectangular waves (Vp-p), sine waves, etc., frequency characteristics will be different. Attention should be paid to this point.

Reverse Connection

There is polarity in magnetic sounder input. Even if a reverse-polarity connection is made, sound is produced, but it is not certain that sound pressure specifications will be satisfied. In the case of a reverse connection, the operating direction of the magnetic field will change (attraction \leftrightarrow repulsion), and resonance frequency (fo) will after, so it is possible that sound pressure at the standard frequency will decline or deviation will become larger.

Frequency characteristics caused by voltage changes

There may be cases in which a magnetic sounder is used at voltages other than the rated voltage. Note that frequency characteristics stated in the catalog are those at the time of the rated voltage. Frequency characteristics during input at voltage

other than the rated voltage changes as shown in Fig. 3. As input voltage becomes lower, resonance frequency (fo) of the magnetic sounder rises; as input voltage becomes higher, fo reduces. Because resonance frequency (fv) of the resonator does not change in relation to voltage, the frequency band becomes narrow when voltage is low, while the band widens to the low frequency side when voltage is high. If voltage is too low, fo may rise above the standard frequency, causing a substantial reduction of sound pressure. (Fig. 3)

Average consumption current

The average consumption current (mA), as set forth in the catalog, is described in the form of MAX.00. This means that, if the rated voltage is applied without limiting electric current, the average current value will not surpass 00mA. Be careful, as it is not meant that electric current exceeding 00mA must not be applied to the product. In reality, maximum current 2 to 3 times higher than the average current is required as peak current. Therefore, a driving current that can supply sufficient current should be provided. If the peak current is restricted, there can be a case in which sound pressure will not be output as specified.

(Example) In the case of QMB-111PN, whose average current is MAX. 10mA, prepare a driving circuit that can supply the peak current of at least 30mA.

Fig. 1 Construction view of QMX series

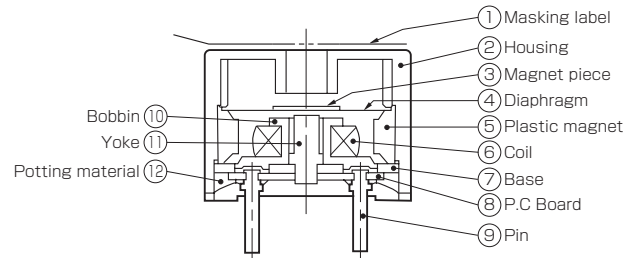


Fig. 2 Measuring Circuit

Our standard circuit for measurement is as shown below:
(VCE=0.15 volts or lower)

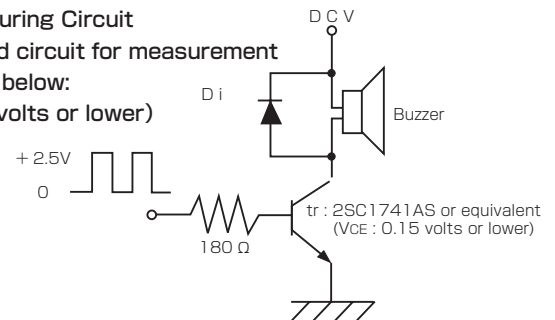
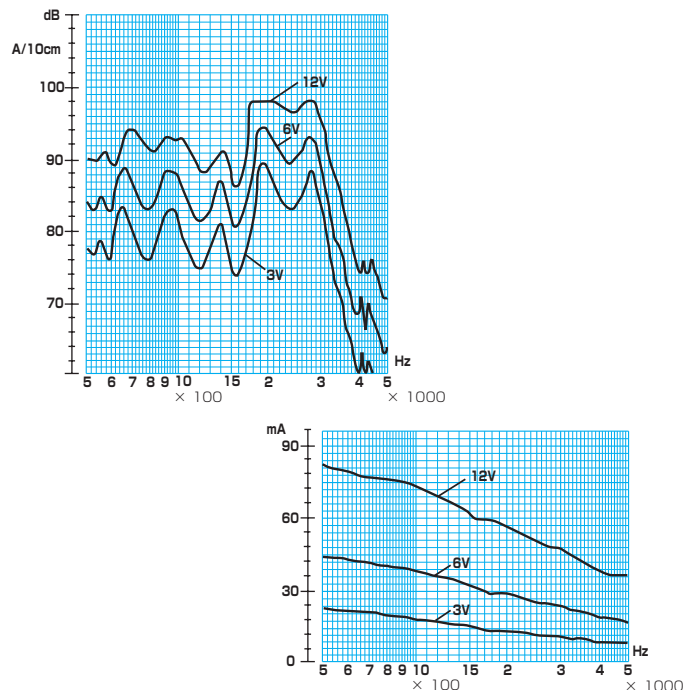


Fig. 3



Resonance Effect of Helmholtz

Sounders are usually built into equipment and used in that state. At that time, users may have various needs, such as "raising sound pressure" or "widening the frequency band." By installing a resonator on the case in which the sounder is contained, etc., it is possible to make sound characteristics closer to these requirements. On this occasion, the "resonance effect of Helmholtz," which can be used for reference purposes, is hereby introduced. To improve the characteristics, it is possible to widen the frequency band or to raise the sound pressure of the standard frequency or desired frequency by setting the resonance frequency (f_v) of the external resonator for the sounder use at a level slightly higher than double the standard frequency, a desired frequency close to it, or the consonance frequency (f_0) of the sounder. The resonance effect formula of Helmholtz shown in Fig. 4 represents a theoretical formula that demonstrates the relationship between f_v of the external resonator and the size of the resonator. Because the effect of the resonator incorporated in the sounder is not included, it is necessary to take the acoustic combination with the resonator of the sounder in actual setting. The usual method is to incorporate the sounder in the real body of the external resonator and adjust its sound emission hole, etc., while considering the value, calculated through the formula, and to seek optimization. (Fig. 4)

<Example of Execution (Experiment)>

The degree of improvement in the characteristics attained through the addition of a resonator to the outside of the sounder is explained, using the results of an experiment employing the sounder QMB-105P. The standard frequency of this product is 2,048 Hz, while sound pressure specification for the product as a signal unit is min 70 dB (typical 77 dB) in terms of sound pressure at 10 cm. (Fig. 5) Because this sounder has only a small space in front of the diaphragm, it does not have resonance frequency (f_v). Therefore, it was considered that, even if it is incorporated, little effect will arise on the external resonator, because its space capacity is small. Dimensional conditions for the external resonator, shall be in accordance with Fig. 6. (Fig. 5 and Fig. 6)

1. Expansion of the band

In order to widen the frequency band to be used to 2,048 Hz - 2,700 Hz, it is considered to set f_v for the external resonator in Fig. 6 at around 2,700 Hz. The theoretical diameter of the sound release hole, obtained by solving the relational expression in Fig. 4, is: $D=1.7\text{mm}$. If the value is slightly reduced to $D=1.5\text{mm}$, for subsequent fine adjustment, the theoretical f_v based on the relational expression becomes 2,460 Hz. The f_v value resulting from real measurement arises at 1,700 Hz because of the effect of the signal-unit characteristics of the sounder.

The actual measurement value will be equal to the characteristics shown in Fig. 7. Thus, compared with the signal unit case, the frequency band will be expanded. (Fig. 7)

2. Paising the sound pressure

To increase the sound pressure of the standard frequency of 2,048 Hz above that of the single unit, f_v for the external resonator in Fig. 6 is assumed to be set at 4,100 Hz, which is twice the standard frequency. If $D=3.3$ is assumed, the theoretical f_v based on the relational expression 4,270 Hz. The f_v value resulting from real measurement, however, will generate at around 4,000 Hz due to the single-unit effect, etc., of the sounder.

The real measurement value proves to be as shown in Fig. 8, and it is clear that the sound pressure level at 2,048 Hz is higher than for the single unit. In this case, however, the sound is audibly high-pitched, because the second harmonic portion will increase.

Based on the aforementioned experimental example, the resonance effect of Helmholtz and its significance are believed to be understood.

Points of attention in setting an external resonator are as follows. ① if the sounder has a resonator of its own, there is a possibility that the theoretical value of the relational expression in Fig. 4 and the real measurement value will be substantially different, as the resonator or the sounder and the external resonator combine acoustically. In this case, it is necessary to adjust the actual equipment of the external resonator, attaining optimization.

② To ensure the resonance effect of the resonator, it is necessary to reduce the sound resistance of the sound emission hole. If the sound emission hole of the external resonator is reduced too much, however, it is possible that no satisfactory outcome will be produced, even if the same frequency is set.

If sufficient resonance space cannot be secured for the external resonator, open a sound issuance hole, a size at least equal or larger than the sound emission hole, of the sounder on the equipment case, to ensure satisfactory characteristics for the single unit of the sounder, then operate the equipment.

Fig. 4

$$f_v = \frac{CD}{4} \sqrt{\frac{1}{\pi V(L+0.75D)}}$$

Where

- f_v : resonant frequency of resonator [Hz]
- V : volume of resonance chamber [mm^3]
- D : diameter of sound emission hole [mm]
- L : depth of sound emission hole [mm]
- C : speed of sound = approx. 344000 [mm/sec]

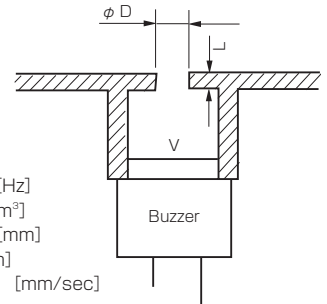


Fig. 5 Frequency response without additional resonator

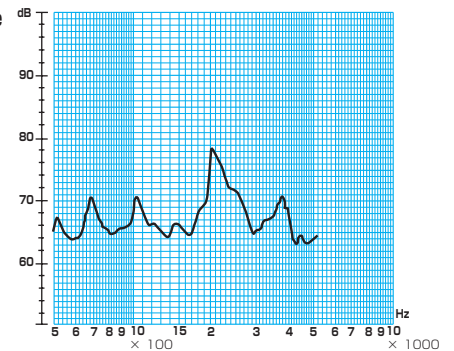


Fig. 6 Geometrical conditions

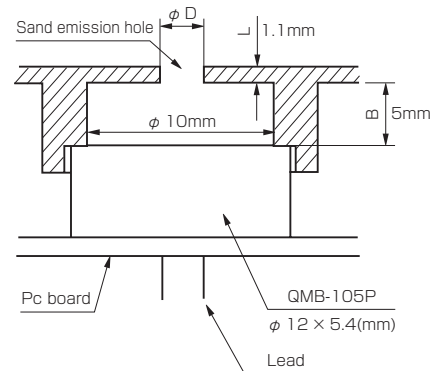


Fig. 7 Frequency response with resonator (Design I)

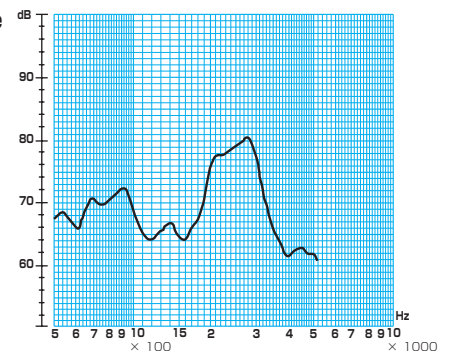
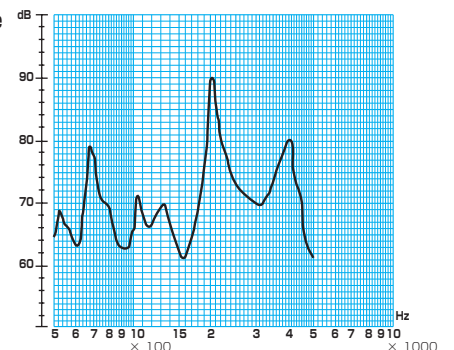


Fig. 8 Frequency response with resonator (Design II)



Magnetic Sounder
 Reflow type
 Non-washable type
 Washable type
 Magnetic Buzzer
 Electric Sound type (Washable)
 Vibrating Hammer type (Non-washable)
 Dynamic Speaker (Non-washable)
 Technical data

MAGNETIC BUZZER (SELF-CONTAINED DRIVE CIRCUIT)

OPERATION PRINCIPLES AND CONSTRUCTION

ELECTRIC SOUND TYPE BUZZER

These types of electro magnetic buzzers (as pictured in Fig. 1) contain coils which are wound in such a manner to produce L1 for driving, and L2 for feedback purposes (as shown in Fig. 2). When current flows through coil L1 and the diaphragm begins to vibrate, coil L2 detects its vibration, providing feedback to the base of the transistor so that the oscillation becomes synchronized with the vibration of the diaphragm.

Fig. 1 Cut-away view of type TMB

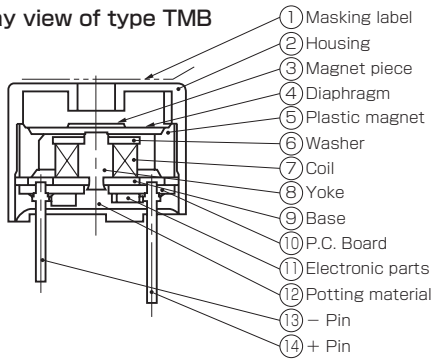
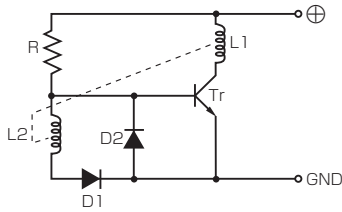


Fig. 2 Circuit diagram of type TMB



CHARACTERISTICS

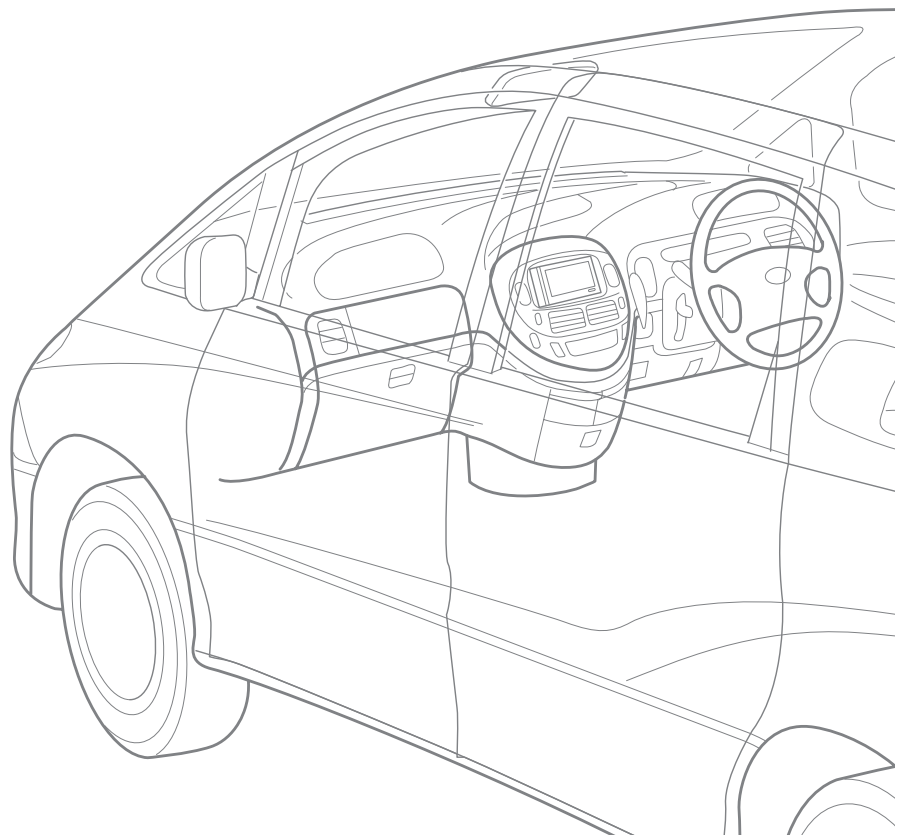
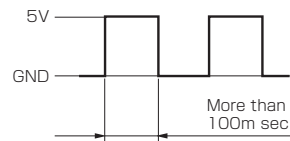
RESPONSE TIME

The buzzer will take a certain time to produce a sound at its fundamental frequency with its built-in driver. The time required to generate a sound after application of a rated voltage in the respective specifications as a response time. In case it is intended to use the buzzer for producing a pulsed sound output, it must be designed with special attention on the response time. It is recommended to apply the voltage at least for a time twice as much as the response time specified.(Fig. 3)

<Example>

For an intermittent operating of the buzzer TMB whose response time is specified as 50 ms, it is recommended to apply the voltage for at least 100 ms.

Fig. 3 Response time



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

SUPPLEMENTAL INFORMATION ON SPEAKER HANDLING

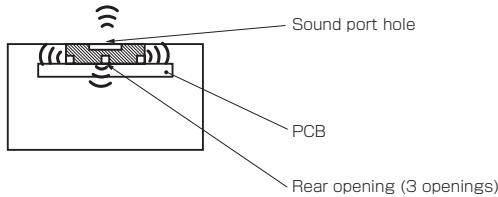
1) Notes for Designing

1-1) Overview

The speaker vibrates a membrane to generate sound. The membrane emits sound from its front side and back side at the same time. The sound from the front side and the sound from the back side are in opposite phases. When these sounds are combined, they balance each other out to reduce sound pressure level.

If you want to increase the SPL efficiently, you need to make a design that cuts the sound from the sound port (front side) off from the sound from the rear openings (back side). Take consideration about this.

Note) When using one of our reflow speakers (SAE-20A, NDT-03C), use care not to block the rear openings (3 openings) if you install other components near these openings.



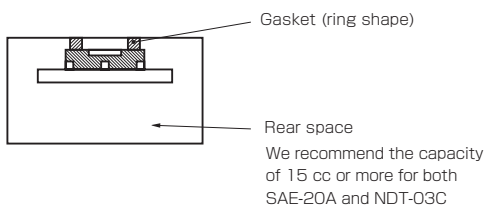
1-2) Designing the Sound Port in the Cover

The top cover should have a hole area of 10 mm² (approximately equivalent to 3.5 mm dia.; SAE-20A) or larger, or 7 mm² (approximately equivalent to 3 mm dia.; NDT-03C) or larger. These hole areas are preferable because the holes do not receive sound pressure.

When the top cover and the speaker are closely in contact, you should insert a gasket (sealing) in the gap between them. The gasket prevents sound leakage. So, you can reduce the difference in SPL that may be caused by assembling processes.

In addition, you can prevent the blocking of some part of the sound port of the speaker by applying the top cover.

When you use one of our reflow speakers (SAE-20A, NDT-03C), we recommend that you seal the gap by a gasket with the internal diameter of 16 mm dia. and the thickness of 1 mm (SAE-20A) or by a gasket with the internal diameter of 6 mm dia. and the thickness of 1 mm (NDT-03C).



1-3) Improving the Sealing Performance for the Back Space

Make a design that enhances the sealing performance for the backside space (back space) of the speaker. Such design prevents diffraction of sound from the back side. So, the speaker can exercise its proper ability.

1-4) Influence on Other Components

The speaker has a magnet. Consider your design not to arrange the speaker near other components that are susceptible to magnetism.

2) Notes for Assembling

2-1) Reflow Temperature

Use caution not to allow the speaker to be subjected to the reflow temperature that exceeds the temperature and the time listed in the specifications. Otherwise, the membrane is damaged, and abnormal sound may be generated.

2-2) Foreign Matter Prevention

Consider assembling processes to prevent dirt, dust, solder balls, flux, and the like from entering into the speaker from the sound port or back openings. They may cause abnormal sound. The speaker has a magnet. Exercise extreme care about iron dust and the like. They are attracted by the magnet.

2-3) Flux Cleaning

Do not clean the speaker.



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

SOUND PRESSURE & TONE

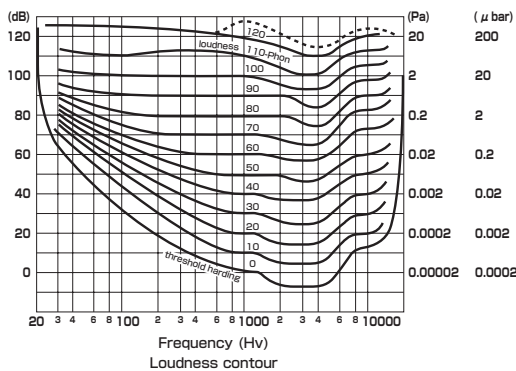
dB AND PHON

1. Sound pressure level is referred to as Sound Output and rated in dB (decibel). DB is defined as the sound pressure level in logarithmic ratio to a sound pressure on the basis of the minimal sound pressure ($20 \mu\text{Pa}$) whose 1 KHz sound that a person in good condition can hear out. The sound pressure level is calculated as shown below in measuring an unspecified sound pressure P (μPa).

$$\text{Sound pressure level (dB)} = 20 \log (P/0.0002)$$

2. The term phon is a unit which describes loudness level as is the case of the decibel. Generally, even the sound level being equal, it is hard for us to hear out the sound clearly due to frequencies. "Loudness contour" is a statistically calculated collection comprising sounds of the same loudness with every frequency based on the 1 KHz sound. The phon is formed through corrections of the sound pressure levels, basing the contour.

For measurement of the sound pressure, the sound level meter possessing the A weighting is employed, which shows relatively corrected values in accordance with the loudness contour. This way the term dB is considered to be phon in specifications.



SOUND PRESSURE AND DISTANCE

As there are differences in the measuring distances when manufacturers make the measurement of sound pressure, the following formula is recommended for calculation on occasions when a buzzer itself is tested or compared with a planned finished product.

However, as far as the calculated is concerned, it is a theoretical one and therefore subject to change, depending upon circumstances and conditions.

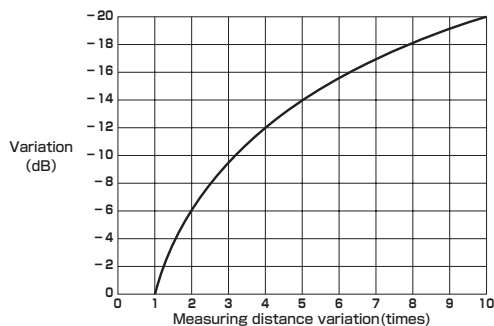
The formula is :

$$B = A + 20 \log(La/Lb)$$

A : sound pressure value at distance La
B : sound pressure value at distance Lb

The table below is to shape up relations between the measuring distance variation and the sound pressure variation for reference.

Measuring distance variation	2 times	3 times	4 times	5 times	6 times	7 times	8 times	9 times	10 times
Sound pressure variation (db)	-6.02	-9.54	-12.04	-13.98	-15.56	-16.90	-18.06	-19.08	-20.00



<Example> 10cm : 80dB → 30cm : $80 - 9.54 = 70.46$ (dB)

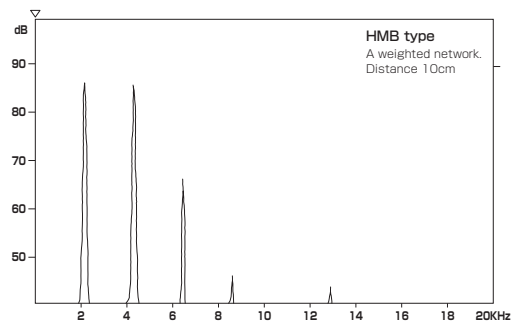
TONE

The tone output, generated by buzzers, is essential in product design. A recommended way of selecting a desired tone is by listening to the different tones produced by the different buzzer. Additionally, FFT analysis is usable for visual tone selection method. The sound is not an oscillation of a single frequency, but as a collected body of individual frequencies. The analysis is to diagnose the ratio of constituent frequencies. The following is a sample analysis of our typical buzzer.

① Transducer with drive circuit (e.g. HMB type)

Transducer with drive circuit (e.g. HMB type) & without drive circuit Fig. 1 shows how the peep sound is composed of a collected body of the fundamental frequency and its integer fold frequencies. This sound composed of integer fold frequencies is generally referred to as a single sound which has a clearer tone than the low pitched buzzers have.

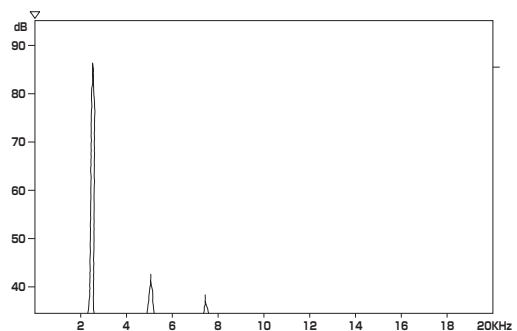
Fig. 1 HMB type FFT analysis



② Piezoelectric transducer

The transducer produces the peep sound closer to the pure sound, which is composed of almost the fundamental frequency. Compared with the transducer, it is likely to sound relatively less mellow.(Fig. 2)

Fig. 2 Piezo type FFT analysis



Magnetic Sounder

Reflow type

Non-washable type

Washable type

Magnetic Buzzer

Electric Sound type (Washable)

Vibrating Hammer type (Non-washable)

Dynamic Speaker (Non-washable)

Technical data

SOLDERING

SOLDERING AND WASHING

Soldering conditions

The sealed miniature sound transducers by Star should not be exposed to extremely high temperatures for prolonged periods of time. As excessive heat will degrade the sealing performance of the unit, soldering should be conducted as quickly as possible.

Recommended temperature and time for soldering	
250°C	within 5 seconds
350°C	within 1.5 seconds

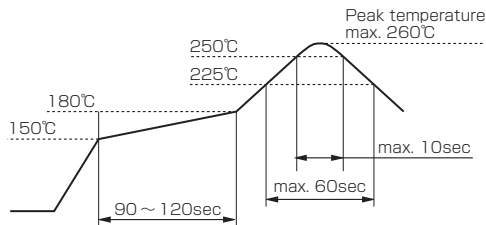
Dip soldering

Dip soldering may be conducted only in the case of washable products. As for non washable products, dip soldering should not be implemented.

Recommended reflow oven temperature profile for reflowable transducers

Recommended temperature profile for lead-free solder

All reflow type buzzer is available by the following condition.



Washing :

Washable type transducers.

Along with other electronic components, these transducers may be washed with cleaning solvents after the soldering process. However, some types of solvents can be harmful to these devices.

Non washable type transducers.

Most cleaning solvents will be damaging to these devices, therefore wave soldering & washing should be avoided.

FLUX REMOVING SOLVENTS

In view of the recent requirement for total elimination of ozone-depleting chemicals, we recommend our customers to use deionized water for their cleaning process at the conditions given below, instead of CFC that conventionally used.

(Condition for cleaning)

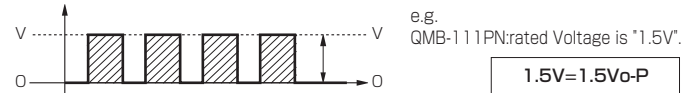
Cleaning solvent	Deionized water
Solvent temperature ...	55±5°C
immersion time	5±0.5 minutes

※Please contact us if there is any question.

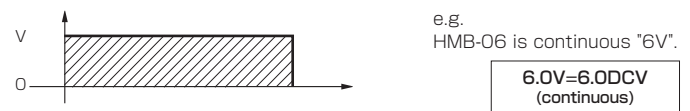
RATED VOLTAGE

The term "Rated Voltage" in the specification of Star's Transducers and Buzzers are described as:

For Miniature Audio Transducers (External Drive Circuitry)

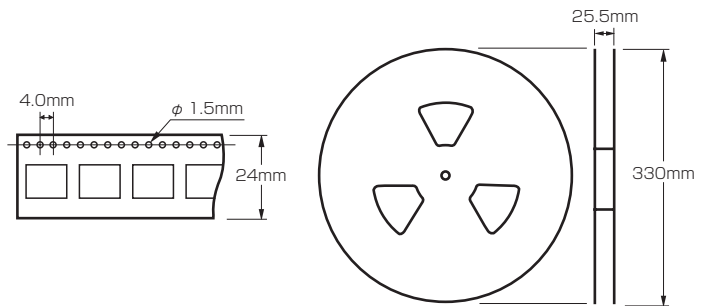


For Miniature Audio Transducers and Low Pitched Sound Buzzers (Self-Contained Drive Circuitry)



Packing of reels for surface-mount buzzers

The packing of surface-mount buzzer reels, are by the standard of JIS C 0806. The size of all reels are shown as bellow.



With regard to tapes employed to pack the buzzer, pocket size and pocket pitch vary depending on each product, so please ask about suitable ones. Regarding the size and pitch of emboss holes, all are the same, however.

The numbers of introduced products contained in individual reels are as shown below:

Model	piece	Model	piece
MQT/MZT/MUT/MLT	1,000 pcs.	NAT	300 pcs.
NFT	2,000 pcs.	SAE/NDT	500 pcs.

CAUTION

Safety Precautions

Use these products within the specified operation voltage scope for their correct, safe use.

Read technological data included in this catalog before use of any product.

Storage / Processing Conditions

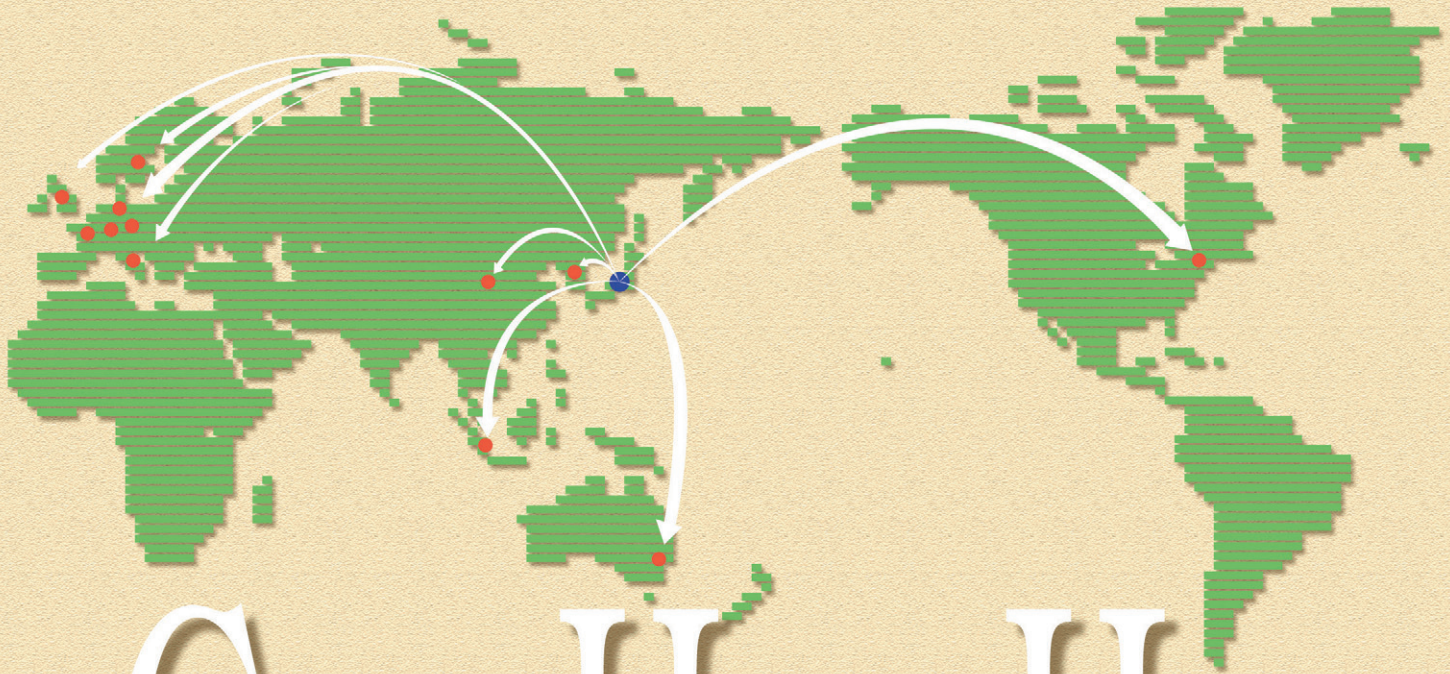
- If this buzzer is placed together with other buzzers in a disorderly way in a single box, the bent portion of its pin, the liquid prevention label (washable-type products), and the buzzer proper may be damaged, and the overall equipment may become nonconformant; as such, much care should be taken.
- Install the product in a place not exposed to direct sunlight, and store it in a room where temperature and humidity changes are as little as possible. (Temperature 5°C-30°C ; humidity 40-60%)

- During storage, the atmosphere should be free of any noxious gas, and it should likewise be relatively dust-free.
- During storage, no weight should be placed on the product that could disfigure or change it.
- The storage period should be limited to one year or less in the packed state.

Caution about Contents of This Catalog

- For reasons of technological improvement, these specifications may be changed without notice.
- Contents herein may not be used or printed without obtaining prior approval.
- This catalog is effective as of Feb. 2009.

Audio products of Star Micronics Co., Ltd are well known for their rich product lineup. These products are popular throughout the world for their high technology and high productivity.



G

Global Network

Star Micronics maintains a sales agent system consisting of 14 sales companies and agents in North America, Europe, and Asia. Please contact Star Micronics Co.,Ltd. If you would like to obtain information about a near by sales company.

H

High Technology

- Succeeded in the development and mass production of SMT sounders for the first time in the world.
- Succeeded in developing the world's first super-thin magnetic sounder
- Star holds a great number of patents.
- Product development based on advanced analysis and measurement based on advanced analysis and measurement/CAD methods.
- Accumulation of abundant sound design technology and know-how.

H

High Productivity

- Thorough quality control system.
- Acquired ISO9001 qualification in July 1997.
- Acquired ISO/TS16949 qualification in March 2006.
- Acquired ISO14001 qualification in April 2001.
- Achieved superiority in reliability and competitive power through compounding and automatization of parts.
- Overwhelming production achievements.
- Realization of a three-production-base system that enabled stabilized supply.



ISO 9001
ISO/TS 16949
BUREAU VERITAS
Certification



Hotline

If you have any questions about purchasing our products, please feel free to telephone us for direct, immediate answers.

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