

LEADED • LOW FREQUENCY kHz BAND
CERAMIC RESONATORS
LXZT



FEATURES:

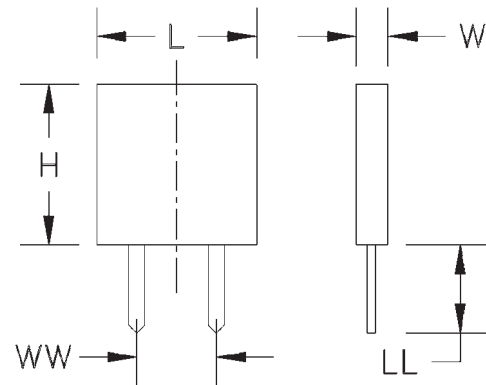
- Excellent Environmental Resistance.
- Standard Frequency Range from 190kHz to 1250 kHz
- Packaging Tape and Reel Option (-T)
- Low Cost
- Low Resonant impedance

APPLICATIONS:

- Microprocessor Clocks.

STANDARD SPECIFICATIONS

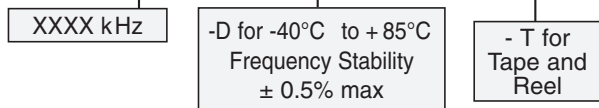
PARAMETERS	SPECIFICATIONS
Frequency Range	190 kHz - 1250 kHz
Resonant Impedance	(See Table below)
Operating Temperature	-20°C to + 80° C (See Options)
Frequency Tolerance @ 25°C	±0.5% max.
Frequency Stability over Temp	± 0.3% max.
Load Capacitance C_L (C_1 C_2)	(See Table below)
Aging in 10 Years	± 0.5% max.



NOTE 1: Please contact us for higher or lower frequencies.
 Environmental and mechanical specifications on page 68, Group 5.
 Marking, see page 77.

ORDERING OPTIONS

LXZT - Frequency - Temperature - Packaging



Test Circuit

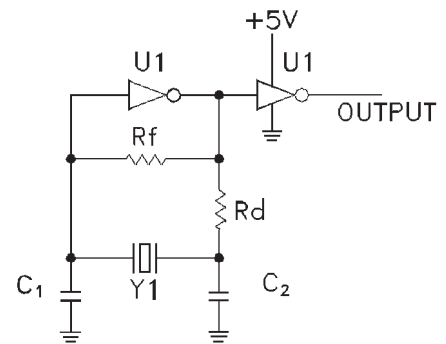


TABLE 1

FREQUENCY RANGE (See Note 1)	RESONANT IMPEDANCE	C1 (pF) ± 20%	C2 (pF) ± 20%	LENGTH (L) in (mm)	WIDTH (W) in (mm)	HEIGHT (H) in (mm)	LL in (mm)	WW in (mm)
190 kHz ~ 249 kHz	20 Ω max.	330	470	0.53 (13.5)	0.15 (3.8)	0.57 (14.5)	0.75 (9)	0.4 (10.3)
250 kHz ~ 375 kHz	20 Ω max.	220	470	0.43 (10.8)	0.15 (3.8)	0.48 (12.2)	0.24 (6)	0.3 (7.7)
376 kHz ~ 429 kHz	20 Ω max.	120	470	0.32 (8)	0.14 (3.6)	0.35 (9.3)	0.14 (3.5)	0.2 (5)
430 kHz ~ 509 kHz	20 Ω max.	100	100	0.3 (7.5)	0.13 (3.3)	0.33 (9.3)	0.14 (3.5)	0.2 (5)
510 kHz ~ 699 kHz	30 Ω max.	100	100	0.3 (7.5)	0.14 (3.5)	0.35 (9.0)	0.14 (3.5)	0.2 (5)
700 kHz ~ 1250 kHz	50 Ω max.	100	100	0.2 (5)	0.11 (2.8)	0.26 (6.8)	0.14 (3.5)	0.1 (2.5)

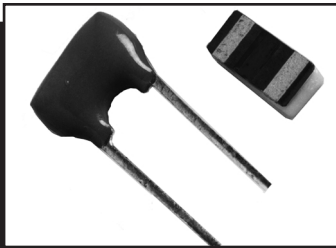
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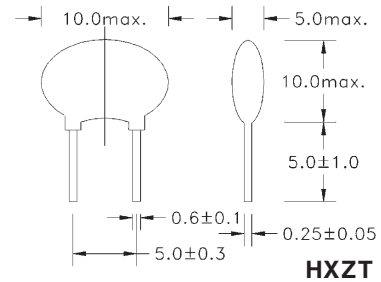
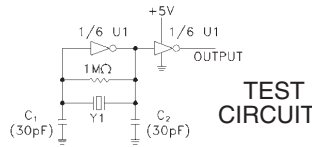




HIGH FREQUENCY LEADED OR SURFACE MOUNT CERAMIC RESONATORS HXZT and ASZT

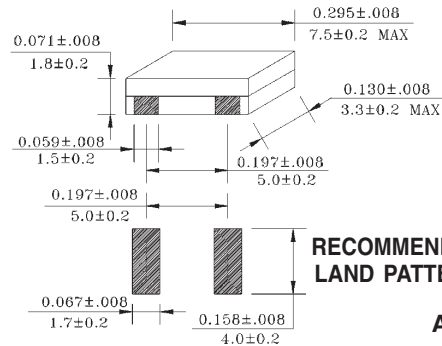
FEATURES:

- Excellent Environmental Resistance.
- Low Resonant impedance; Low Cost.



Dimensions:
Inches (mm)

HXZT



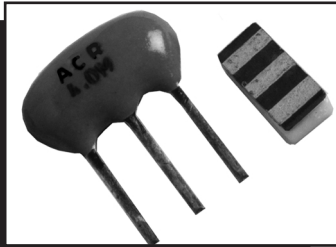
RECOMMENDED
LAND PATTERN

ASZT

STANDARD SPECIFICATIONS

PARAMETERS	HXZT	ASZT
Frequency Range (F_0)	1.26 MHz - 16.0 MHz	1.8 MHz - 8.0 MHz
Operating Temperature (T_{OPR})	-20°C to +80°C (See Options)	
Storage Temperature (T_{STO})	-40°C to +85°C	
Frequency Tolerance @ 25°C	±0.5% max.	
Frequency Stability over Temp.	± 0.3% max.	
Load Capacitance C_L	30 pF	
Aging in 10 Years	± 0.3% max.	

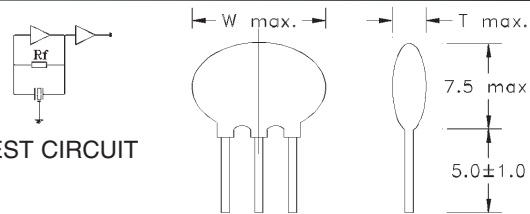
See Note and Ordering Options (Specify Part Number) at bottom of page.



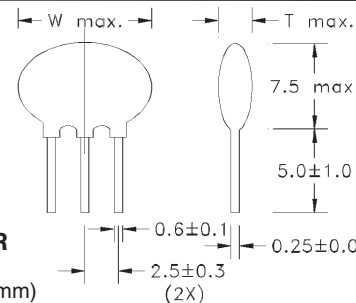
HIGH FREQUENCY LEADED OR SURFACE MOUNT • BUILT-IN CAPACITORS CERAMIC RESONATORS ACR and ASCR

FEATURES:

- Excellent Environmental Resistance; Low Cost.
- Built-in Capacitors to save Space & Components.



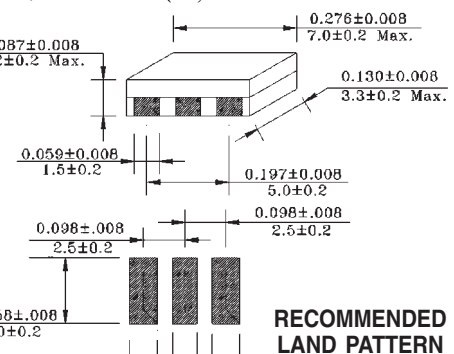
TEST CIRCUIT



ACR

Dimensions: Inches (mm)

Contact us for
higher or lower
frequencies.



RECOMMENDED
LAND PATTERN

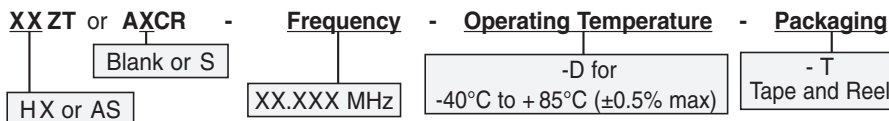
ASCR

STANDARD SPECIFICATIONS

PARAMETERS	ACR and ASCR
Frequency Range (F_0)	1.8 MHz - 8.0 MHz
Operating Temperature (T_{OPR})	-20°C to +80°C (See Options)
Storage Temperature (T_{STO})	-40°C to +85°C
Frequency Tolerance @ 25°C	±0.5% max.
Frequency Stability over Temp.	± 0.3% max.
Aging in 10 Years	± 0.3% max.

Environmental and mechanical specifications on page 68, Group 5.
Marking, see page 79.

ORDERING OPTIONS

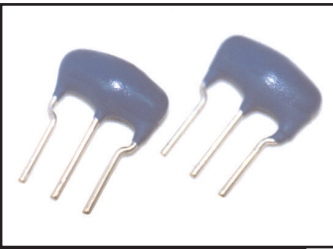


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HIGH FREQUENCY, LEADED, WASHABLE INDUSTRIAL GRADE BUILT-IN CAP CERAMIC RESONATORS AWCR Series

FEATURES:

- Built-in load capacitors.
- High stability washable type.
- Industrial grade.
- Small size, light weight
- Excellent environmental resistance.

APPLICATIONS:

- Remote control systems in vehicles.
- Telephones.
- Industrial electric appliances.
- Clock oscillation for microcontrollers.
- Household electric appliances.

STANDARD SPECIFICATIONS

Series	Frequency Range (MHz)	Frequency Tolerance (% at 25°C)	Stability (% at -40°C to 125°C)	Aging (10 yrs)	Total
AWCRX.XXM	2.00 ~ 6.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%
AWCRX.XXM	6.01 ~ 8.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%
AWCRX.XXM	8.01 ~ 13.49	±0.5% (see options)	±0.9% (see options)	±0.3% (see options)	±1.7%
AWCRX.XXM	13.50 ~ 50.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%

Operating temperature: -40°C to 125°C

Storage temperature: -40°C to 125°C

(*) Stability vs. temperature: ±0.3% @ -20°C to +80°C

Packaging: Bulk: Plastic packing 500pcs.

Ammo pack (Taping): carton box packing: 1,500pcs.

We perform IC characterization to match your application.

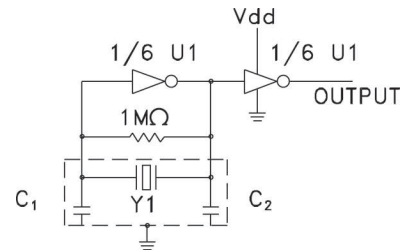
Environmental and mechanical specification, Group 5A.

ORDERING OPTIONS

AWCR - Frequency - CXX - I0XX - S0XX - A0XX - Packaging

XX Cap Value 0XX: % Freq. Stability (**)
0XX: % Freq. Tolerance (**)
-Ammo (Ammo packing)
0XX: % Aging (**)

Test Circuit

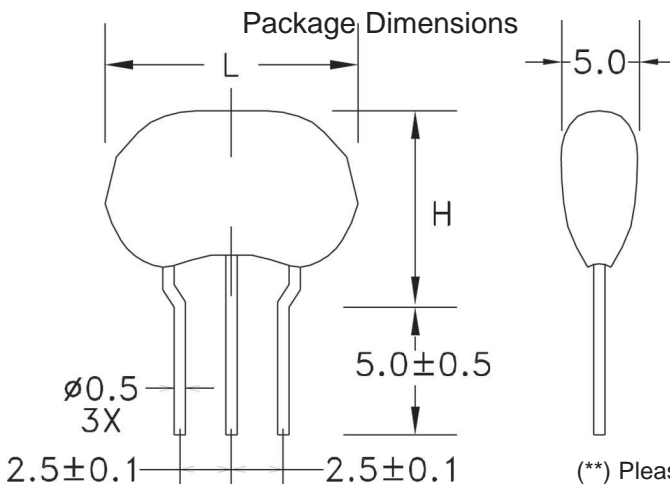


U1: CD4069UB
74HCU04
Y1: RESONATOR
C₁ C₂: 30pF ± 20% (Built-in)

Freq. (MHz)	L (max.)	H (max.)
2.0 ~ 6.0	10.0	8.0
6.01 ~ 8.0	10.0	8.0
8.01 ~ 13.49	10.0	10.0
13.50 ~ 50.0	10.0	10.0

ex: AWCR - 2.44MHz - C05 - I015 - S03 - A01T

C₁ = C₂ = 5pF
±0.15% of tolerance
±0.3% of stability
±0.1% of aging



Dimensions: mm

(**) Please contact us for availability.

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HIGH FREQUENCY, SURFACE-MOUNT, WASHABLE INDUSTRIAL GRADE BUILT-IN CAP CERAMIC RESONATORS AWSCR Series

FEATURES:

- Industrial grade.
- High stability washable type, reflow capable.
- Small size, light weight
- Excellent environmental resistance.

APPLICATIONS:

- Remote control systems in vehicles.
- Telephones.
- Industrial electric appliances.
- Clock oscillation for microcontrollers.
- Household electric appliances.
- Mobile phone, DVD, CD-ROM

STANDARD SPECIFICATIONS

Package Style	Frequency Range (MHz)	Frequency Tolerance (% at 25°C)	Stability (% at -40°C to 125°C)	Aging (10 yrs)	Total
7230	2.00 ~ 6.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%
7230	6.01 ~ 8.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%
3731 or 2520	8.01 ~ 13.49	±0.5% (see options)	±0.9% (see options)	±0.3% (see options)	±1.7%
3731 or 2520	13.50 ~ 20.00	±0.5% (see options)	±0.3% (see options)	±0.1% (see options)	±0.9%
3731 or 2520	20.01 ~ 50.00	±0.5% (see options)	±0.3% (see options)	±0.1% (see options)	±0.9%

Operating temperature: -40°C to 125°C

Storage temperature: -40°C to 125°C

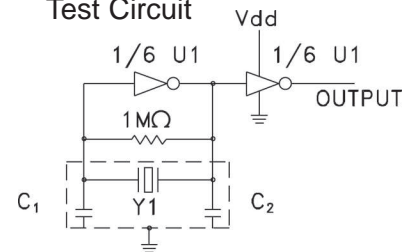
(*) Stability vs. temperature: ±0.3% @ -20°C to +80°C

Packaging: Option Tape and Reel 2,000pcs (7230) and 4,000pcs (3731 or 2520)

We perform IC characterization to match your application.

Environmental and mechanical specification, Group 5A.

Test Circuit



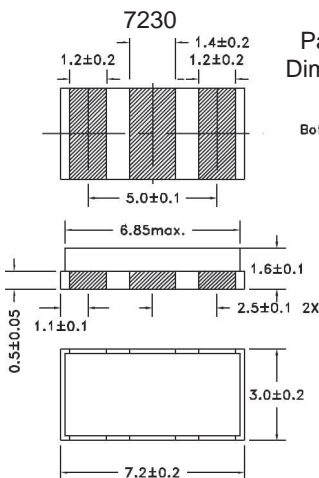
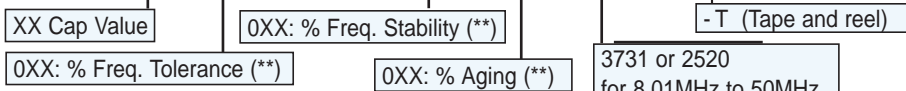
U1: CD4069UB
74HCU04

Y1: RESONATOR

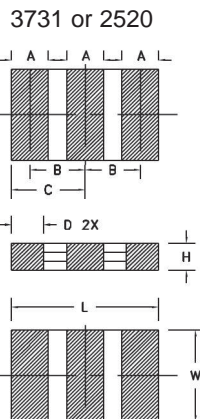
C₁ C₂: 30pF ± 20% (Built-in)

ORDERING OPTIONS

AWSCR - Frequency - CXX - I0XX - S0XX - A0XX - 3731 - Packaging



Package Dimensions



(**) Please contact us for availability.

Type	3731	2520
L ± 0.2	3.7	2.5
W ± 0.2	3.1	2.0
H	1.30 ± 0.1	1.5 max.
A	0.5	0.5
B	1.60 ± 0.2	1.00 ± 0.2
C	1.85 ± 0.3	1.25 ± 0.2
D	0.5	0.5

ex: AWSCR - 4.00MHz - C15 - I015 - S03 - A01T

C₁ = C₂ = 15pF
±0.15% of tolerance
±0.3% of stability
±0.1% of aging

Dimensions: mm

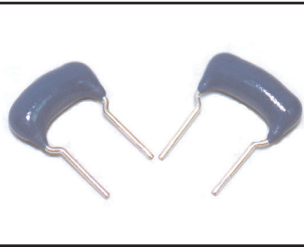


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HIGH FREQUENCY, LEADED, WASHABLE INDUSTRIAL GRADE CERAMIC RESONATORS HWZT Series

FEATURES:

- Industrial grade.
- High stability washable type.
- Small size, light weight
- Excellent environmental resistance.

APPLICATIONS:

- Remote control systems in vehicles.
- Telephones.
- Industrial electric appliances.
- Clock oscillation for microcontrollers.
- Household electric appliances.

STANDARD SPECIFICATIONS

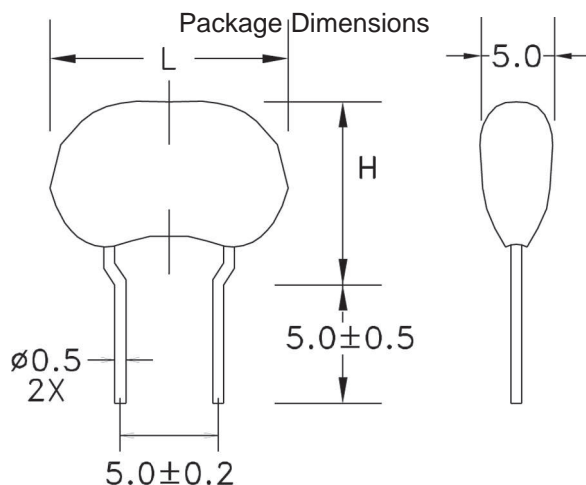
Series	Frequency Range (MHz)	Frequency Tolerance (% at 25°C)	Stability (% at -40°C to 125°C)	Aging (10 yrs)	Total
HWZTX.XXM	2.00 ~ 6.00	±0.5% (see options)	±0.3% (see options)	±0.3% (see options)	±1.0%
HWZTX.XXM	6.01 ~ 8.00	±0.5% (see options)	±0.7% (see options)	±0.3% (see options)	±1.5%
HWZTX.XXM	8.01 ~ 13.49	±0.5% (see options)	±0.9% (see options)	±0.5% (see options)	±1.9%
HWZTX.XXM	13.50 ~ 50.00	±0.5% (see options)	±0.3% (see options)	±0.2% (see options)	±1.0%

Operating temperature: -40°C to 125°C
 Storage temperature: -40°C to 125°C
 (*) Stability vs. temperature: ±0.3% @ -20°C to +80°C
 Packaging: Bulk: Plastic packing 500pcs.
 Ammo pack (Taping): carton box packing: 1,500pcs.
 We perform IC characterization to match your application.
 Environmental and mechanical specification, Group 5A.

ORDERING OPTIONS

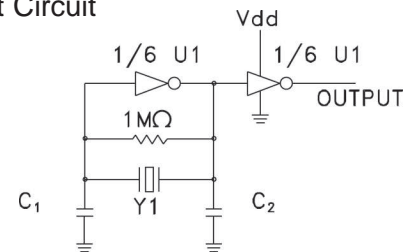
HWZT - Frequency - CXX - I0XX - S0XX - A0XX - Packaging

XX Cap Value 0XX: % Freq. Stability (**)
 0XX: % Freq. Tolerance (**)
 - Ammo (Ammo pack)
 0XX: % Aging (**)



Dimensions: mm

Test Circuit



U1: CD4069UB
 74HCU04 (>8MHz)
 Y1: RESONATOR
 C₁ C₂: 30pF ± 20%

Freq. (MHz)	L (max.)	H (max.)
2.00 ~ 6.00	10.0	8.0
6.01 ~ 8.00	10.0	8.0
8.01 ~ 13.49	10.0	10.0
13.50 ~ 50.00	10.0	10.0

ex: HWZT - 2.44MHz - C05 - I015 - S03 - A01T

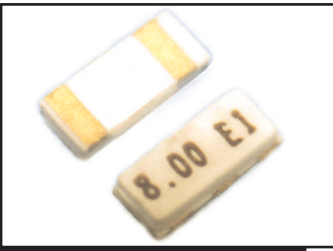
C₁ = C₂ = 5pF
 ±0.15% of tolerance
 ±0.3% of stability
 ±0.1% of aging



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HIGH FREQUENCY, SMD, WASHABLE INDUSTRIAL GRADE CERAMIC RESONATORS AWSZT Series

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- Small size, light weight
- Excellent environmental resistance.

APPLICATIONS:

- Remote control systems in vehicles.
- Telephones.
- Industrial electric appliances.
- Clock oscillation for microcontrollers.
- Household electric appliances.
- Mobile phone, DVD, CD-ROM

STANDARD SPECIFICATIONS

Package Style	Frequency Range (MHz)	Frequency Tolerance (% at 25°C)	Stability (% at -40°C to 125°C)	Aging (10 yrs)	Total
7230	2.00 ~ 6.00	±0.5% (See Options)	±0.3% (See Options)	±0.2% (See Options)	±1.0%
7230	6.01 ~ 8.00	±0.5% (See Options)	±0.4% (See Options)	±0.2% (See Options)	±1.1%
3731	8.01 ~ 13.49	±0.5% (See Options)	±0.9% (See Options)	±0.5% (See Options)	±1.9%
3731 or 2520	13.50 ~ 20.00	±0.5% (See Options)	±0.4% (See Options)	±0.3% (See Options)	±1.2%
2520	20.01 ~ 50.00	±0.5% (See Options)	±0.4% (See Options)	±0.1% (See Options)	±1.0%

Operating temperature: -40°C to 125°C

Storage temperature: -40°C to 125°C

(*) Stability vs. temperature: ±0.3% @ -20°C to +80°C

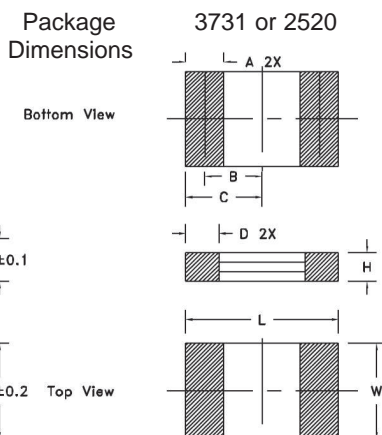
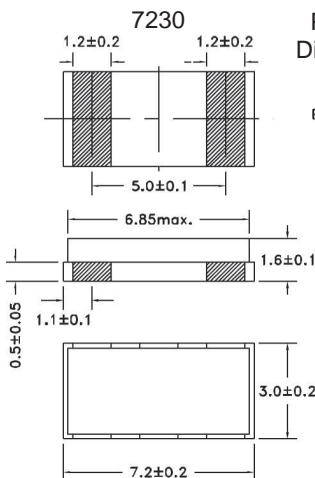
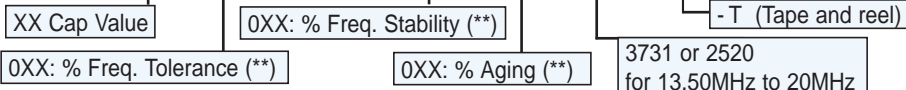
Packaging: Option Tape and Reel 2,000pcs (7230) and 4,000pcs (3731 or 2520)

We perform IC characterization to match your application.

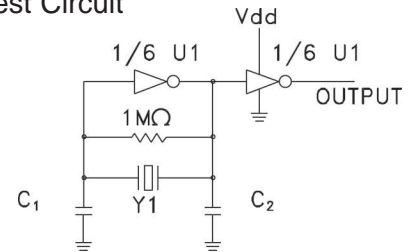
Environmental and mechanical specification, Group 5A.

ORDERING OPTIONS

AWSZT - Frequency - CXX - IOXX - S0XX - A0XX - 3731 - Packaging



Test Circuit



U1: CD4069UB
74HCU04 (>8MHz)
Y1: RESONATOR
C1 C2 : 30pF ± 20%

Type	3731	2520
L ± 0.2	3.7	2.5
W ± 0.2	3.1	2.0
H	1.20 ± 0.2	1.5 max.
A	0.70 ± 0.3	0.5
B	1.50 ± 0.2	1.00 ± 0.2
C	1.85 ± 0.3	1.25 ± 0.2
D	0.6 ± 0.3	0.5

ex: AWSZT - 8.00MHz - C05 - I015 - S03 - A01T

C1 = C2 = 10pF
±0.15% of tolerance
±0.3% of stability
±0.1% of aging

Dimensions: mm

(**) Please contact us for availability.



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CERAMIC RESONATORS

APPLICATION NOTES

GENERAL DESCRIPTION

Why Ceramic Resonators? Ceramic resonators stand between quartz crystal oscillators and LC/RC oscillators in regard to accuracy. They are considerably smaller, require no adjustments, with improved start-up time and low in cost.

Package: Ceramic resonators come with standard, single-in-line package (LXZT and HXZT), 3-leads with built-in capacitors (ACR), surface mount ASZT and ASCR.

Properties: The oscillation of ceramic resonators is dependent upon mechanical resonance associated with their piezoelectric crystal structure. These materials (usually barium titanate or lead-zirconium titanate) have large dipole movement which causes the distortion or growth of the crystal by an applied electric field.

Frequency Range: The available frequency range varies from 190 kHz to 16 MHz.

Frequency Stability: The maximum allowable frequency deviation compared to the measured frequency at 25°C over the temperature window, i.e., -20°C to +80°C. The typical stability is ± 0.3% (±3000ppm).

Frequency Tolerance: The allowable deviation from the nominal frequency at room temperature. Frequency tolerance is expressed in percentage, typical ±0.5% or in parts per millions (ppm), ±5000ppm.

Resonant Impedance: Value of impedance the crystal exhibits in the operating resonant circuit.

Aging: The relative frequency change over a certain period of time. This rate of change of frequency is normally exponential in character. Typically, aging is ±0.3% over 10 years.

Frequency Stability: The maximum allowable frequency deviation compared to the measured frequency at 25°C over the temperature window, i.e., -20°C to +80°C.

Load Capacitance: Load capacitance (C_L) is the amount of capacitance that the oscillator exhibits when looking into the circuit through the two resonator terminals. Load capacitance is expressed in a pair of C1 and C2 with the default values given in table.

Equivalent Circuit: Its equivalent circuit is similar to the quartz crystal equivalent circuit, i.e., consists of a series L1, C1, R1 circuit shunting with a parallel C0 capacitance.

Typical Parameters of Standard HXZT-4.0000MHz:

L ~ 330 μH, C1 - 5pF, C0 ~ 40pF, and Q ~ 900.

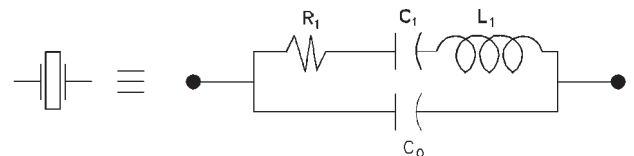


Figure 1

TEST CIRCUIT FOR CERAMIC RESONATORS

Ceramic Resonators with Built-In Capacitors:

It consists of a CMOS inverter with a feedback resistor Rf (See figure 2). The feedback resistor allows oscillation to start when power is initially applied. Its value is generally 1 MΩ. The values of C1 and C2 is given in the table (found on the page) or they can be specified by the customer.

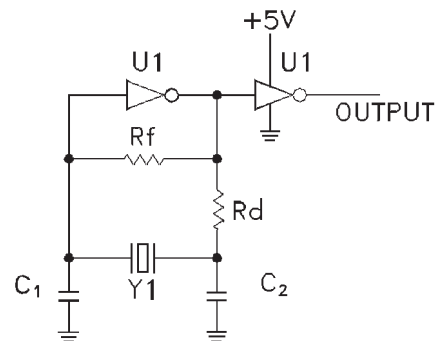


Figure 2