



ABRACON
CORPORATION

A Worldwide Leading Supplier of Electronic Components

The Power of Linking Together

Mission Statement

ABRACON Corporation's mission is to continuously grow by promoting invaluable contributions from our employees and suppliers in order to equip our customers with emerging technology products, and superior service and support.

Quality Policy Statement

It is ABRACON Corporation's objective to design, manufacture, control, and deliver defect-free products and superior service to our valued customers worldwide.

Operations

At ABRACON facilities, parts are manufactured to meet **ISO 9001** and **QS 9000** quality standards. Production is monitored through stringent manufacturing process controls. Post-production testing ensures that all electrical and physical parameters have been met. Static-sensitive product is handled, stored and shipped in an electrostatic discharge controlled environment. Abracan offers full-time product management and applications engineering teams to provide technical support and design custom components for our global network of representatives and customers.



DNV Certificate No.

DET NORSKE VERITAS QUALITY SYSTEM CERTIFICATE

Certificate No. 99-101-U-AQ-0288

This is to certify that the Quality System
of:

ABRACON CORPORATION

At:
29 Journey, Aliso Viejo, CA 92656 USA.
Has been found to conform to Quality Standard:

ISO 9001, 1994
and the requirements of:
QS-9000, 1998

and has been certified in accordance with the requirements of:
QS-9000 Appendix B, Code of Practice

This Certificate is valid for the following products/service ranges:

THE DESIGN, MANUFACTURE AND DISTRIBUTION OF ELECTRONIC COMPONENTS

Place and date:
Houston, Texas 02 July 1999

This certificate is valid until:

02 June 2000

For the Accredited Body:
Det Norske Veritas Certification, Inc.
Houston, Texas, USA
DNV Management Systems Certification
The Netherlands

Rudy Jansen
Sales Director
Management System
DNV Certification, Inc.



QA-9000 Initial Certification Date:
05 October 1997
ISO 9001 Initial Certification Date:
21 June 1998


Gregor Crank
Quality Control
Sand Island

*We Support our Customers, Worldwide,
with Superior Quality,
Professional Customer Service,
Applications Engineering,
Extensive Inventory and
Continuous New Product Offerings.*

WARRANTY:

Abracan products are made to exacting specification control drawings (SCDs). Abracan reserves the right to discontinue or revise its products, their electrical parameters, and physical characteristics. Abracan warrants its products to be free of defects in materials and workmanship as specified. No liability is assumed as a result of improper applications, handling, or deviations from their original specifications, and markings.

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29 Journey • Aliso Viejo, CA 92656 • USA
(949) 448-7070 • FAX: (949) 448-8484

E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com

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5		Frequency Bar Graph

SURFACE MOUNT CRYSTALS

6	ABC2	11.5 x 5.5 x 2.0 mm • Ceramic Glass sealed • 3.5MHz to 30MHz
7	ABLS, ABLS2, ABLS3	11.5 x 4.8 x 4.2 mm • HC49US, Resistance welded • 3.57MHz to 70MHz
8	ABM2	8.0 x 4.5 x 2.0 mm • Ceramic Glass sealed • 6.0MHz to 100MHz
9	ABM3	5.0 x 3.2 x 1.5 mm • Ceramic Glass sealed • 8.0MHz to 60MHz
10	ABM3A	5.0 x 3.2 x 1.1 mm • Ceramic E-Beam sealed • 10MHz to 66MHz
11	ABM3B	5.0 x 3.2 x 1.1 mm • Ceramic Seam sealed • 10MHz to 60MHz
12	ABM3C	5.0 x 3.2 x 1.3 mm • Ceramic Glass sealed • 10MHz to 40MHz
13	ABM4A, ABM4B	7.0 x 5.0 x 1.6 mm • Ceramic Glass sealed • 10MHz to 100MHz
14	ABM7	6.0 x 3.5 x 1.3 mm • Ceramic Glass sealed • 10MHz to 50MHz
15	ABM8	3.2 x 2.5 x 0.9 mm • Ceramic E-beam sealed • 16MHz to 60MHz
16	ABM9	4.0 x 2.5 x 0.8 mm • Ceramic Seam sealed • 13MHz to 32MHz
17	ABMC2	11.0 x 5.0 x 2.0 mm • Ceramic Resistance welded • 3.57MHz to 70MHz
18	ABMM, ABMM1	7.0 x 5.0 x 1.3 mm • Ceramic Seam sealed • 8.0MHz to 125MHz
19	ABMM2	6.0 x 3.5 x 1.2 mm • Ceramic Seam sealed • 12.8MHz to 110MHz
20	ABMM3	6.0 x 3.5 x 1.3 mm • Ceramic Glass sealed • 13MHz to 120MHz
21	ABSM	13.2 x 4.7 x 4.3 mm • Molded Plastic • 3.5MHz to 70MHz
22	ABSM2	12.5 x 4.6 x 3.7 mm • Molded Plastic • 3.57MHz to 70MHz
23	ABSM3 Series	13.0 x 4.3 x 6.2 mm • HC49US, Resistance welded • 3.57MHz to 60MHz
24	ABSM5 Series	13.0 x 5.0 x 5.1 mm • HC49US, Resistance welded • 3.57MHz to 60MHz
25	ABS13	6.90 x 1.4 x 1.3 mm • Molded Plastic • 32.768kHz
26	ABS15	6.80 x 3.0 x 1.55 mm • Molded Plastic • 32.768kHz
27	ABS25	8.7 x 3.8 x 2.5 mm • Molded Plastic • 30kHz to 165kHz
28	AB26TA/B Series	6.0 x Ø2.0 mm • Cylindrical type Reflowable • 30kHz to 165kHz
29	AB308R, AB310R	8.8 x Ø3.0 mm • Cylindrical type Reflowable • 3.5MHz to 70MHz

LEADED CRYSTALS

30	AB	11.5 x 5.0 x 13.5 mm • HC49U Resistance welded • 1.0MHz to 160MHz
31	ABL, ABL2, ABL3	11.5 x 5.0 x 2.0 mm • HC49US Resistance welded • 3.57MHz to 70MHz
32	ABU, ABU4, ABU5	7.8x 3.1 x 8.0 mm • UM type Resistance welded • 6MHz to 200MHz
33	AB38T, AB26T	8.3 x Ø3.2 mm or 6.2 x Ø2.1 mm • Cylindrical type • 30kHz to 200kHz
34	AB308, AB310	10.0 x Ø3.2 mm • Cylindrical type • 3.5MHz to 90MHz

SURFACE MOUNT CERAMIC RESONATORS

35	ASZT, ASCR	7.4 x 3.4 x 1.8 mm • With or Without Built-in Capacitors • 2MHz to 50MHz
36	AWSZT Series	7.2 x 3.0 x 1.6 mm • Washable Industrial Grade • 2MHz to 50MHz
37	AWSCR Series	7.2 x 3.0 x 1.6 mm • Washable Industrial Grade Built-in Capacitors • 2MHz to 50MHz

LEADED CERAMIC RESONATORS

38	LXZT	13.5 x 3.5 x 14.5 mm • Low frequency band • 190kHz to 1250kHz
39	HXZT, ACR	10.0 x 5.0 x 15 mm • High frequency • With or Without Built-in Caps. • 1.2MHz to 34MHz
40	HWZT	10.0 x 5.0 x 10.0 mm • Washable Industrial Grade • 2MHz to 50MHz
41	AWCR	10.0 x 5.0 x 10.0 mm • Washable Industrial Grade • Built-in Caps. • 2MHz to 50MHz

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SURFACE MOUNT CRYSTAL OSCILLATORS

42	ASF1, ASFL, ASFL1	5.0 x 3.2 x 1.6 mm • 5Vdc or 3.3Vdc, HCMOS/TTL • Ceramic Glass sealed • 1.5MHz to 125MHz
43	ASG, ASGL	6.0 x 3.5 x 1.8 mm • 5Vdc or 3.3Vdc, Ceramic Glass sealed • 0.5MHz to 125MHz
44	ASL, ASL1	7.0 x 5.08 x 1.8 mm • 5Vdc, HCMOS/TTL • Ceramic Seam sealed • 1MHz to 125MHz
45	ASV, ASV1	7.0 x 5.08 x 1.8 mm • 3.3Vdc, Ceramic Seam sealed • 1.5MHz to 150MHz
46	ASL2, ASV2	7.3 x 5.08 x 1.05 mm • 5Vdc or 3.3Vdc, Ceramic Seam sealed • 1.5MHz to 85MHz
47	ASM	14.0 x 8.95 x 4.7 mm • 5Vdc, HCMOS/TTL • Molded Plastic • 1MHz to 70MHz
48	ASML	14.0 x 8.95 x 4.7 mm • 3.3Vdc, HCMOS/TTL • Molded Plastic • 1MHz to 160MHz
49	ASLP, ASVP	7.0 x 5.0 x 1.6 mm • 5Vdc or 3.3Vdc, Programmable, Ceramic Seam sealed • 1MHz to 125MHz
50	ASMP, ASMLP	14.0 x 8.95 x 4.7 mm • 5Vdc or 3.3Vdc, Programmable, Plastic Molded • 1MHz to 125MHz

LEADED CRYSTAL OSCILLATORS

51	ACO	20.2 x 12.6 x 5.08 mm • Full-size DIP, 5Vdc, HCMOS/TTL • 500kHz to 200MHz
52	ACOL, ACHL	20.2 x 12.6 x 5.08 mm • Full,Half-size DIP, 5Vdc or 3.3Vdc • 32.768kHz to 200MHz
53	ACOL1, ACHL 1	20.2 x 12.6 x 5.08 mm • Full,Half-size DIP, 2.5Vdc, HCMOS • 1MHz to 85MHz
54	ACH	12.7 x 12.7 x 5.6 mm • Half-size DIP, 5Vdc, HCMOS/TTL • 32.768kHz to 200MHz
55	ACT, AHT	20.2 x 12.6 x 5.08 mm • Full,Half-size DIP, 5Vdc, TTL • 500kHz to 70MHz
56	ADCO, ADCO1	20.2 x 12.6 x 7.2 mm • Full-size DIP, 5Vdc, HCMOS/TTL • 20MHz to 150MHz
57	ACOS	20.2 x 12.6 x 5.08 mm • Full-size DIP, 5Vdc, Sine output • 8MHz to 40MHz
58	ACPE, ACPEL	20.2 x 12.6 x 7.2 mm • Full-size DIP, 5Vdc or 3.3Vdc, PECL • 10MHz to 200MHz
59	ACOP, ACHP Series	20.2 x 12.6 x 5.08 mm • Full,Half-size DIP, 5Vdc or 3.3Vdc• Programmable •1MHz to 125MHz

SURFACE MOUNT VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXOS)

60	ASLV, ASVV	7.0 x 5.0 x 1.7 mm • Ceramic, 5Vdc or 3.3Vdc, HCMOS/TTL • 1.54MHz to 60MHz
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LEADED VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXOS)

61	ACVX1220, ACVX1220L	20.2 x 12.6 x 8.0 mm • Full-size DIP, 5Vdc or 3.3Vdc, CMOS/TTL • 1MHz to 160MHz
62	ACVX1222, ACVX1222L	20.2 x 12.6 x 5.08 mm • Full-size DIP, 5Vdc or 3.3Vdc, CMOS/TTL • 1MHz to 200MHz
63	AHVX1025, AHVX1025L	12.7 x 12.7 x 5.6 mm • Half-size DIP, 5Vdc or 3.3Vdc, CMOS/TTL • 1MHz to 200MHz
64	ACVX1240	20.2 x 12.6 x 5.08 mm • Full-size DIP, 5Vdc, Sine output • 8MHz to 52MHz
65	ACVX1224	20.2 x 12.6 x 7.2 mm • Full-size DIP, 5Vdc, CMOS/TTL • 65MHz to 300MHz

SMD VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED (VCTXOS)

66	ASTX-01, ASVTX-01 Series	11.4 x 9.6 x 4.0 mm • HCMOS/TTL or Clipped sine, 5Vdc or 3.3Vdc • 1.25MHz to 27MHz
67	ASVTX-02	18.5 x 12 x 5.0 mm • HCMOS/TTL or Clipped sine, 5Vdc or 3.3Vdc • 1MHz to 45MHz
68	ASTX-03, ASVTX-03 Series	18.3 x 11.7 x 4.7 mm • HCMOS/TTL or Clipped sine, 5Vdc • 2MHz to 25MHz
69	ASVTX-04, ASVTX-05 Series	11.4 x 9.8 x 2.8 mm • Leadless SMT, 5Vdc or 3.3Vdc • 10MHz to 25MHz
70	ASTX-06, ASVTX-06, ASVTX-07	9.0 x 7.0 x 2.0 mm • Leadless SMT, 3Vdc • 12MHz to 19MHz
71	ASVTX-08	7.0 x 5.0 x 1.8 mm • Ceramic High-density SMT, 3Vdc • 12.6MHz to 19.8MHz
72	ASTX-09, ASVTX-09 Series	5.0 x 3.2 x 1.5 mm • Ceramic Seam Sealed SMT, 5Vdc or 3Vdc • 12.8MHz to 19.68MHz

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29 Journey • Aliso Viejo, CA 92656 • USA
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E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com



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LEADED VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED (VCTXOs)

73 ACTX1018, ACVTX1018	18.3 x 12 x 8.0 mm • DIP, TTL/CMOS, Sine Wave, 3.3Vdc or 5Vdc • 1MHz to 45MHz
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SURFACE MOUNT VOLTAGE-CONTROLLED OSCILLATORS (VCOs)

74 ACV Series	9.0 x 6.8 x 1.8 mm • Strip-line resonator, 750MHz to 2.4GHz
75 ACV Package Outline	Package Outline
76 Order Form	Custom Voltage-Controlled Oscillators

SURFACE MOUNT MONOLITHIC CRYSTAL FILTERS (MCFs)

77 ASCF21U, ASCF45U	7.2 x 5.2 x 1.5 mm • Ceramic Seam sealed, 21.4MHz, 45MHz Fundamental
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LEADED MONOLITHIC CRYSTAL FILTERS (MCFs)

78 ACF10M Series	11.05 x 4.65 x 13.5 mm • 10.7MHz
79 ACF21U, ACF45U Series	7.8 x 3.2 x 8.0 mm • 21.4 MHz • 45MHz Fundamental

SURFACE MOUNT SAW DEVICES

80 SAW Devices	Introduction
81 ASR315E, ASR433E	5.0 x 5.0 x 1.7 mm • Ceramic One-port SAW Resonator • 315MHz, 433.92MHz
82 ASR390E, ASR868E	5.0 x 5.0 x 1.7 mm • Ceramic One-port SAW Resonator • 390MHz, 868.35MHz
83 ASQ915S3	3.8 x 3.8 x 1.5 mm • Ceramic Two-port SAW Resonator • 915MHz
84 AFS433E	5.0 x 5.0 x 1.7 mm • Ceramic RF SAW Filter, 433.92MHz

LEADED SAW DEVICES

85 ASR418	9.8 x 9.8 x 3.6 mm • TO-39 package One-port SAW Resonator • 418MHz
86	Standard SAW Packages
87 - 88	SAW Devices Developed Frequencies
89 Order Form	Custom SAW Devices
90 - 91	SAW Application Notes

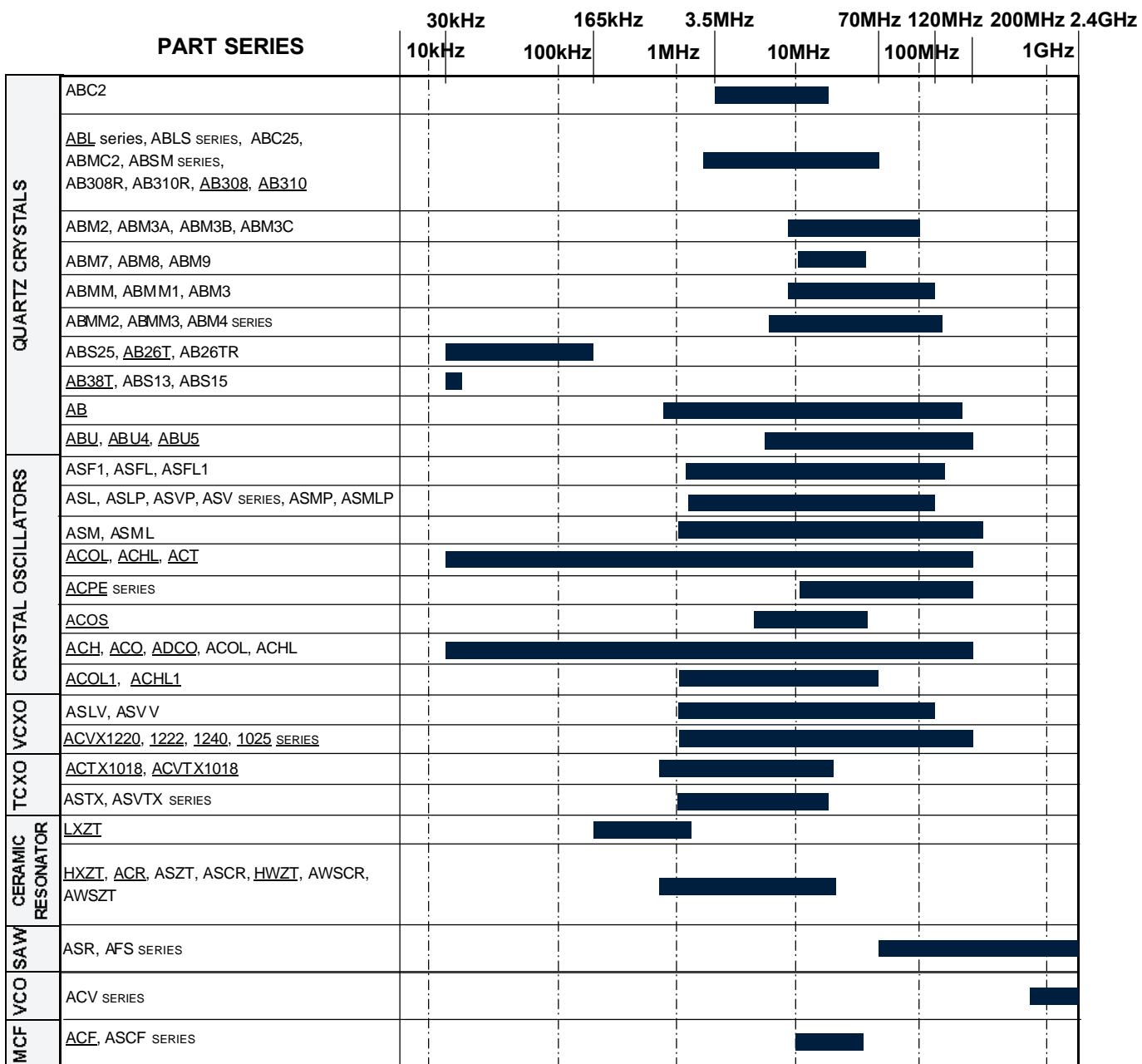
APPENDIX

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105 -107 Appendix C	Environmental and Mechanical Specifications
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C3 Automotive	Abracor Automotive Capabilities



FREQUENCY BAR GRAPH

ABRACON FREQUENCY CONTROL PRODUCTS



Underline items are through-hole products. Others are surface-mount products. For reference only.
Please see details in specification sheets.



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11.5 x 5.5 x 2.0 mm

MICROPROCESSOR CRYSTALS LOW FREQUENCY, CERAMIC SURFACE MOUNT ABC2

FEATURES:

- Low Frequency in small size SMD, 2.0mm height ideal for application to high density circuit boards.
- Excellent environmental and heat resisting due to the ceramic package.
- Extended temperature -40°C to +85°C for industrial applications.

APPLICATIONS:

- Wide range in communication equipment, measuring equipment.
- Commercial and Industrial applications.

STANDARD SPECIFICATIONS

Frequency Range	3.5MHz - 30MHz
Operation Mode	Fundamental, AT
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-55°C to +125°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR)	200 Ω max. for 3.5MHz ≤ F < 4.0MHz 150 Ω max. for 4.0MHz ≤ F < 6.0MHz 100 Ω max. for 6.0MHz ≤ F < 10.0MHz 80 Ω max. for 10MHz ≤ F < 14.0MHz 50 Ω max. for 14MHz ≤ F ≤ 30MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	16pF (See Options)
Drive Level	100μW max.
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

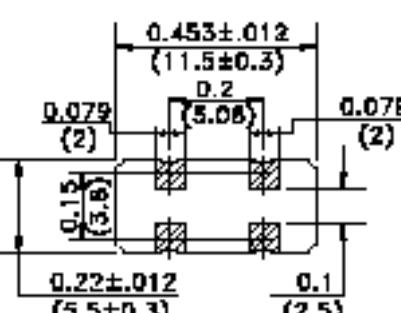
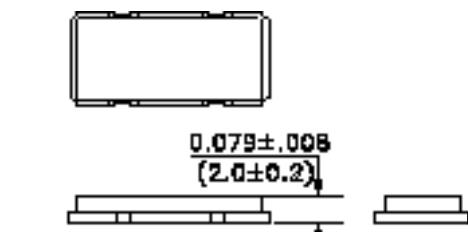
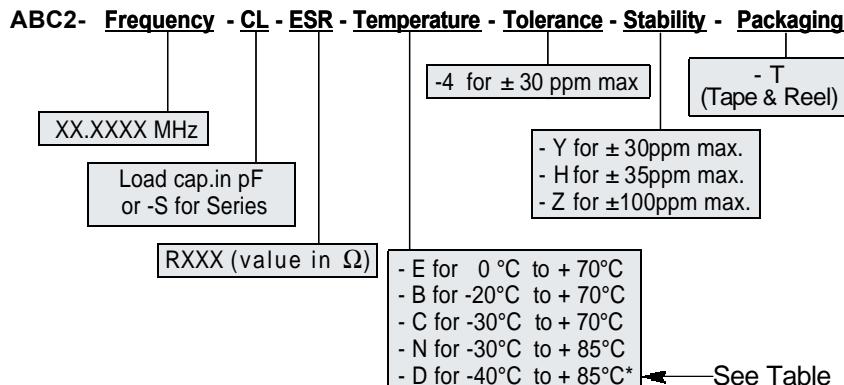
Environmental, and mechanical specifications, see appendix C, group 2

Marking, see appendix G. Recommended handling, see appendix F.

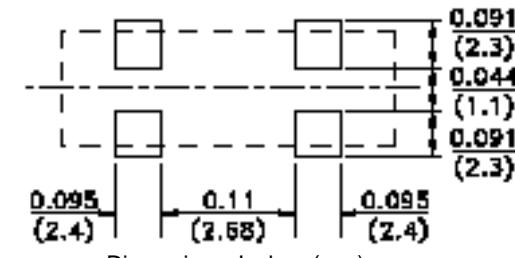
Tape and Reel, (2,000 pcs / reel), see appendix H.

Application notes, see appendix A. Reflow profile, see appendix E.

ORDERING OPTIONS



Recommended land pattern



Dimensions: Inches (mm)

TEMPERATURE TABLE FOR -D

FREQUENCY (MHz)	D F/F (ppm) MAX.
3.5 - 3.999	± 150
4.0 - 5.999	± 100
6.0 - 9.999	± 80
10.0 - 30.00	± 60

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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MICROPROCESSOR CRYSTALS
AT49 (HC49 US) LOW PROFILE SURFACE MOUNT
ABLS, ABLS2, ABLS3



11.5 x 4.8 x 4.2 mm

FEATURES:

- High reliability, Low cost.
- Tight stability and extended temperature.
- Low profile. (2.5mm max.)
- Reflow capable.

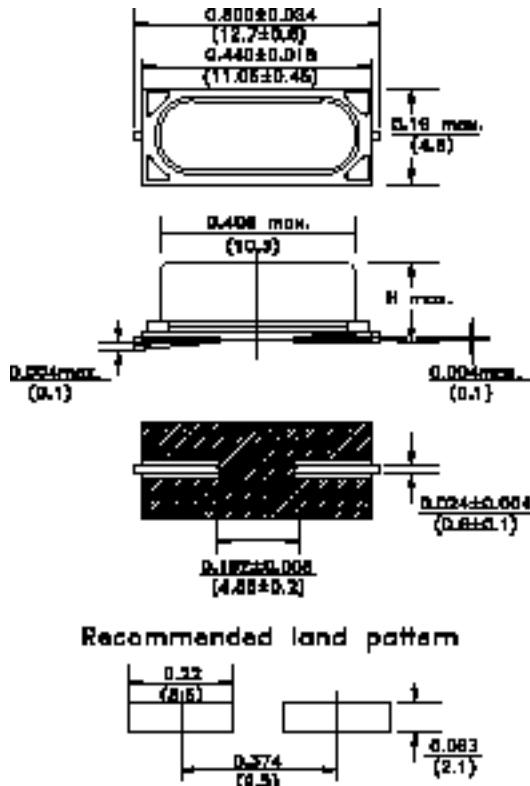
APPLICATIONS:

- Wireless applications.
- Computers, modems, communications.
- Automotive and industrial.
- Hi-precision TCXO and clock applications.

Height Options	
PN#	H max.
ABLS	0.160 (4.2)
ABLS2	0.130 (3.3)
ABLS3	0.099 (2.5)

STANDARD SPECIFICATIONS

Frequency Range	3.579545MHz - 70.00MHz
Operation Mode	3.579545 MHz ~ 24.0MHz ~ (Fundamental) 24.01MHz ~ 50.00MHz ~(Fund. AT or BT) 24.01MHz ~ 70MHz ~ (3rd- Overtone)
Operating Temperature	0°C to +70°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency stability over temp.	±50ppm max. (See Options)*
Equivalent Series Resistance (ESR)	180 Ω max. for 3.579MHz ≤ F < 5.000MHz 120 Ω max. for 5.000MHz ≤ F < 6.000MHz 100 Ω max. for 6.000MHz ≤ F < 8.000MHz 80 Ω max. for 8.000MHz ≤ F < 9.000MHz 60 Ω max. for 9.000MHz ≤ F < 10.00MHz 50 Ω max. for 10.00MHz ≤ F < 16.00MHz 40 Ω max. for 16.00MHz ≤ F ≤ 50.00MHz Fundamental 100 Ω max. for 24.01MHz ≤ F < 32.00MHz 80 Ω max. for 32.00MHz ≤ F ≤ 70.00MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	1mW max., 100μW correlation
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance;	500MΩ min. at 100Vdc ±15V



Please see environmental, and mechanical specifications, see appendix C. Group 1.

Tape and Reel, see appendix H.(1,000pcs./reel)

Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A.

Recommended handling, see appendix F.

ORDERING OPTIONS

ABLSX	- Frequency	- CL	- ESR	- Temperature	- Tolerance	- Stability	- Mode	- Packaging
Blank, 2 or 3		RXXX	(value in Ω)					-T for tape and reel
XX.XXXX MHz	-A for -10°C to + 60°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C			-H5 for ± 5ppm** -1 for ± 10ppm -7 for ± 15ppm -2 for ± 20ppm -3 for ± 25ppm -4 for ± 30ppm	-R5 for ± 5ppm** -U for ± 10ppm -G for ± 15ppm -X for ± 20ppm -W for ± 25ppm -Y for ± 30ppm -H for ± 35ppm			-F for Fundamental AT> 24MHz -FB for Fundamental BT> 24MHz**
Load cap.in pF or -S for Series								* BT cut ±100ppm max. -10°C to +60°C ** Please call for details.

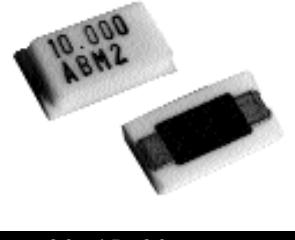
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MICROPROCESSOR CRYSTALS
CERAMIC SURFACE MOUNT MINIATURE
ABM2

8.0 x 4.5 x 2.0 mm

FEATURES:

- Low profile 2.0 mm; suitable for thin equipment.
- Ceramic package assures high reliability.
- Tight tolerance and stability available.
- Suitable for solder reflow.
- Fundamental frequency up to 50MHz.

APPLICATIONS:

- Microprocessor crystals.
- Modems, Communication, Test equipment.

STANDARD SPECIFICATIONS

Frequency Range	6.000 MHz - 100 MHz
Operating Mode	6.000MHz ~ 50MHz (Fundamental) 30MHz ~ 100MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	$\pm 50\text{ppm}$ max. (See Options)
Frequency Stability over Temp.	$\pm 50\text{ppm}$ max. (See Options)**
Equivalent Series Resistance (ESR)	200 Ω max. for 6.00MHz $\leq F <$ 8.00MHz 100 Ω max. for 8.00MHz $\leq F <$ 10.00MHz 80 Ω max. for 10.00MHz $\leq F <$ 12.00MHz 50 Ω max. for 12.00MHz $\leq F \leq$ 50.0MHz
3rd Overtone	70 Ω max. for 30MHz $< F \leq$ 100MHz
Shunt Capacitance C_0	7pF max.
Load Capacitance C_L	18pF (See Options)
Drive Level	500 μW max., 100 μW correlation
Aging @ 25°C per Year	$\pm 5\text{ppm}$ max.
Insulation Resistance	500M Ω min. at 100Vdc $\pm 15\text{V}$

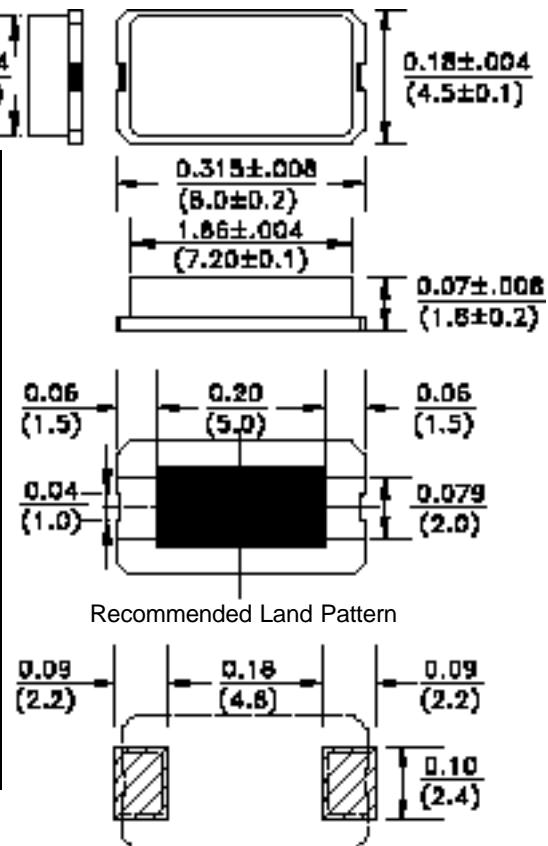
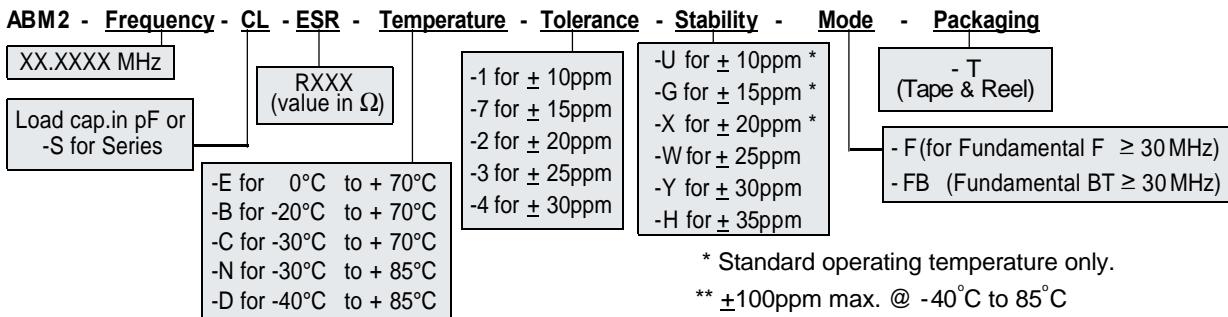
Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G. Recommended handling, see appendix F.

Tape and Reel, see appendix H.(1,000 pcs/reel)

Application notes, see appendix A. Reflow profile, see appendix E.

ORDERING OPTIONS

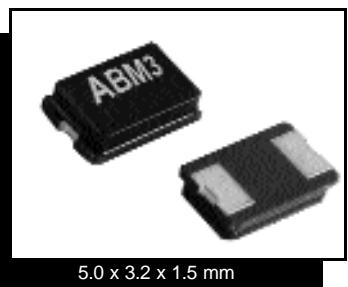


CONNECTION



Dimensions: Inches (mm)

MICROPROCESSOR CRYSTALS
ULTRA MINIATURE CERAMIC SURFACE MOUNT
ABM3



5.0 x 3.2 x 1.5 mm

FEATURES:

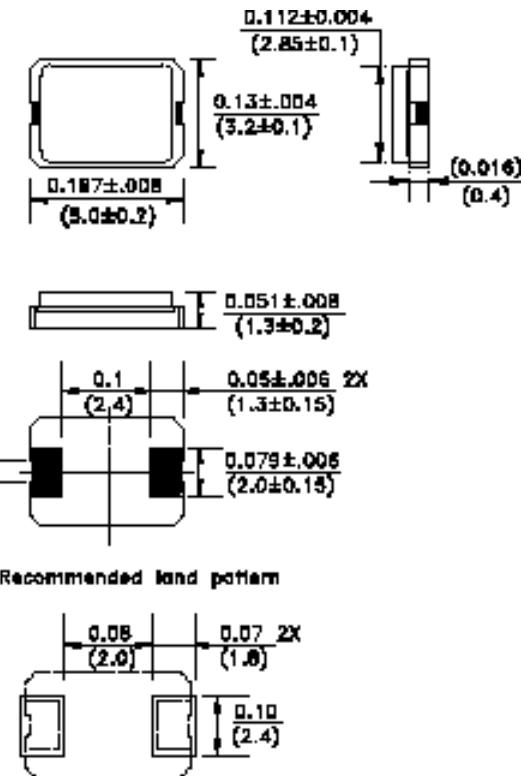
- Low in height. (1.5 mm max.)
- High precision crystal.
- Fundamental frequency up to 60MHz.
- Compact designs suitable for high density applications.
- SMD; suitable for solder reflow.
- Superior heat-resistant glass sealing.

APPLICATIONS:

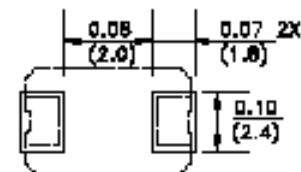
- Computers, Modems, Communication, Test equipment.
- Thin equipment.

STANDARD SPECIFICATIONS

Frequency Range	8.000 MHz - 60.000 MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±100ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	500 Ω max. for 8.0 MHz ≤ F < 9.0MHz 200 Ω max. for 9.0MHz ≤ F < 10.0MHz 60 Ω max. for 10.0MHz ≤ F < 16.0MHz 50 Ω max. for 16.0MHz ≤ F ≤ 60.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100µW max., 10 µW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V



Recommended Land Pattern

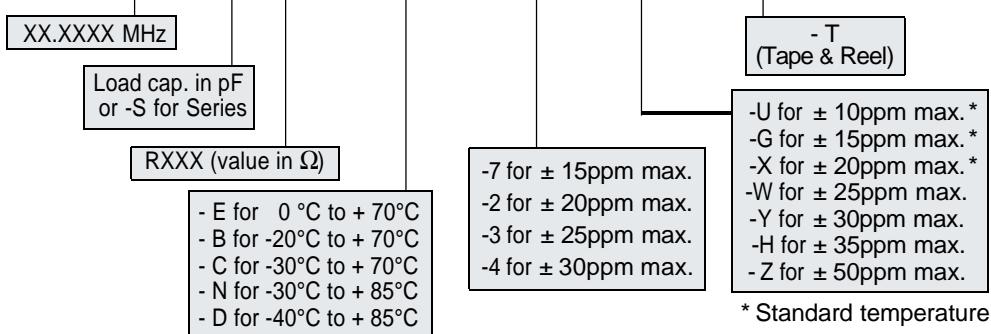


CONNECTION

Dimensions: Inches (mm)

ORDERING OPTIONS

ABM3 - Frequency - CL - ESR - Temperature - Tolerance - Stability - Packaging



* Standard temperature only

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5.0 x 3.2 x 1.1 mm

MICROPROCESSOR CRYSTALS

ULTRA MINIATURE CERAMIC SURFACE MOUNT

ABM3A

FEATURES:

- Ultra miniature size 5.0 x 3.2 x 1.1 mm max.
- E-Beam sealing.
- Ceramic package and metal lid assures high precision and reliability.

- Fundamental mode.
- Tight Stability available.
- Suitable for reflow.

APPLICATIONS:

- Computers, Modems, Microprocessors.
- Communication, Test equipment.
- High density applications.
- PCMCIA and wireless applications.

STANDARD SPECIFICATIONS

Frequency Range	10.000MHz - 66.000MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	150 Ω max. for 10.000MHz ≤ F < 12.000MHz 100 Ω max. for 12.000MHz ≤ F < 16.000MHz 70 Ω max. for 16.000MHz ≤ F < 30.000MHz 50 Ω max. for 30.000MHz ≤ F ≤ 66.000MHz
Shunt Capacitance Co	7pF max.
Load Capacitance CL	18pF (See Options)
Drive Level	100µW max., 10µW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

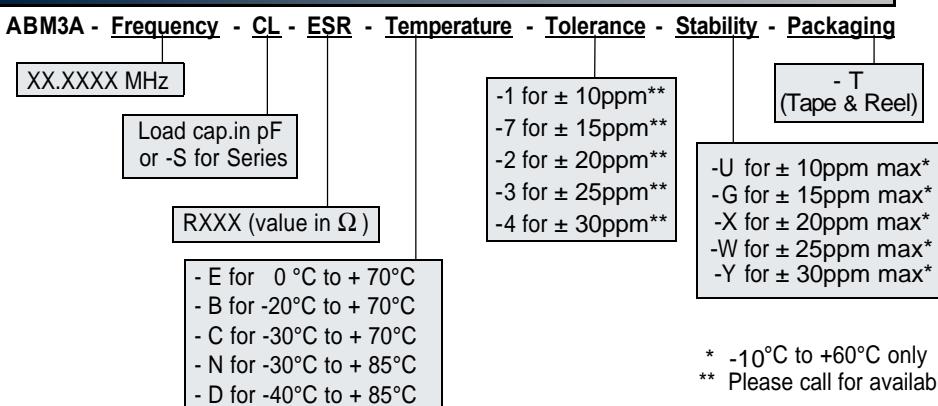
Environmental, and mechanical specifications, see appendix C. Group 2.

Tape and Reel (1,000 pcs/reel).see appendix H.

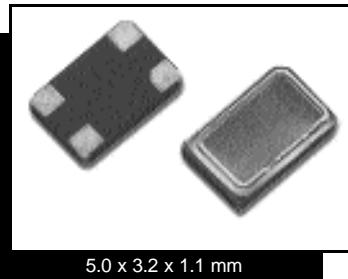
Marking, see appendix G. Recommended handling, see appendix F.

Application notes, see appendix A. Reflow profile, see appendix E.

ORDERING OPTIONS



MICROPROCESSOR CRYSTALS
ULTRA MINIATURE CERAMIC SURFACE MOUNT
ABM 3B



5.0 x 3.2 x 1.1 mm

FEATURES:

- Ultra miniature size 5.0 x 3.2 x 1.1 mm max.
- Suitable for reflow.
- Ceramic package and metal lid assures high precision and reliability.
- Fundamental mode.
- Tight Stability available.
- Seam sealing.

APPLICATIONS:

- Cellular telephones, Pagers.
- Communication and Test equipment.
- High Density applications.
- PCMCIA and wireless applications.

STANDARD SPECIFICATIONS

Frequency Range	10.000 MHz - 60.000 MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	100 Ω max. for 10.000MHz ≤ F < 12.000MHz 70 Ω max. for 12.000MHz ≤ F < 16.000MHz 50 Ω max. for 16.000MHz ≤ F ≤ 60.000MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100μW max., 10μW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

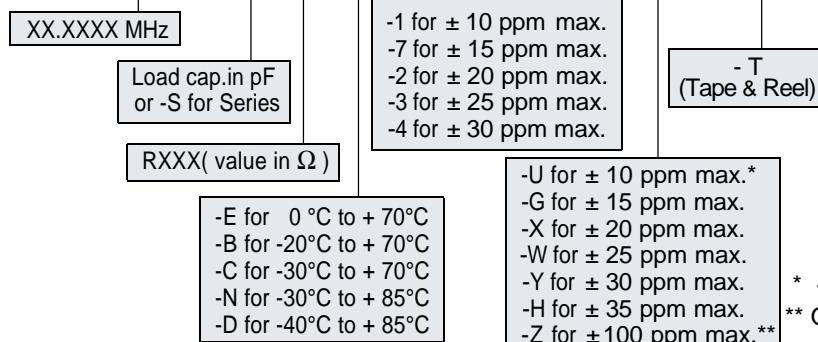
Tape and Reel, see appendix H.(1,000 pcs/reel)

Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS

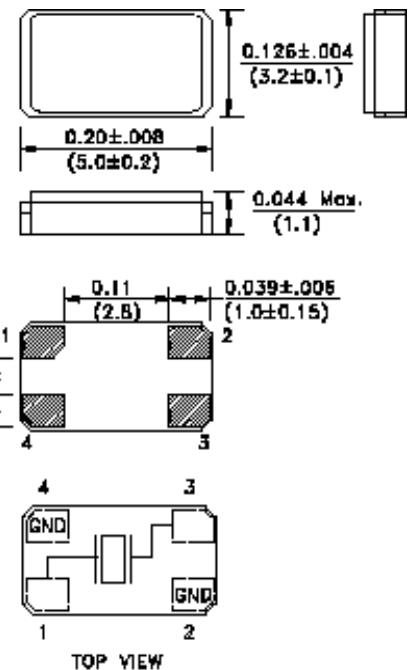
ABM3B - Frequency - CL - ESR - Temperature - Tolerance - Stability - Packaging



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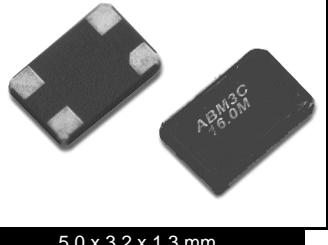
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Dimensions: Inches (mm)

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MICROPROCESSOR CRYSTALS
ULTRA MINIATURE CERAMIC SURFACE MOUNT
ABM3C

5.0 x 3.2 x 1.3 mm

FEATURES:

- Ultra miniature size 5.0 x 3.2 x 1.3 mm max.
- Suitable for reflow.
- Ceramic package with heat-resistant glass sealing.
- Fundamental mode.
- Tight Stability available.

APPLICATIONS:

- Cellular telephones, Pagers.
- Communication, Test equipment.
- High density applications.
- Cordless telephones, Fasimiles

STANDARD SPECIFICATIONS

Frequency Range	10.000MHz - 40.000MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +70°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	60 Ω max. for 10.0MHz ≤ F < 16.0MHz 50 Ω max. for 16.0MHz ≤ F ≤ 40.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100 μW max., 10 μW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

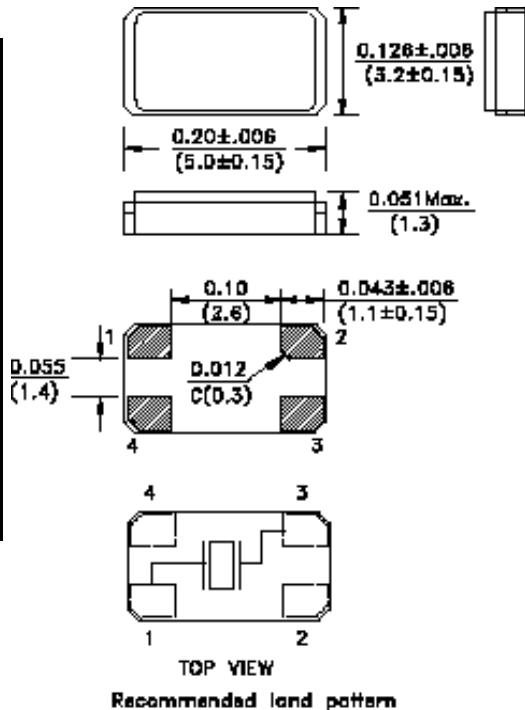
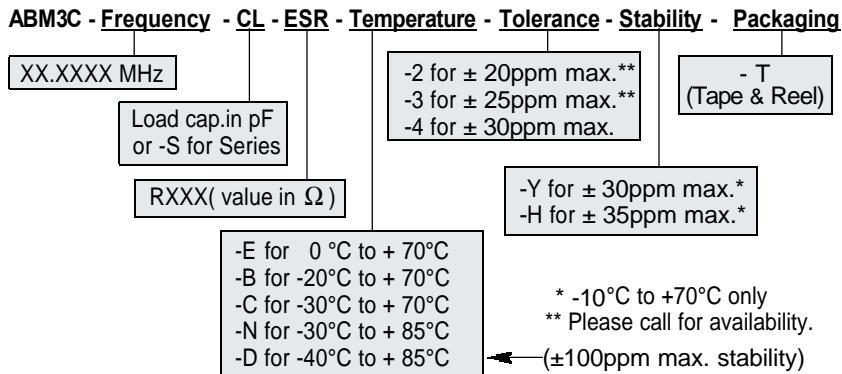
Environmental, and mechanical specifications, see appendix C. Group 2.

Tape and Reel, see appendix H.(1,000 pcs/reel)

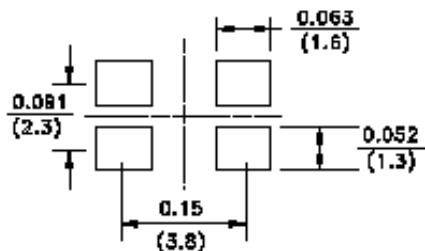
Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS



TOP VIEW
Recommended land pattern



Dimensions: Inches (mm)

MICROPROCESSOR CRYSTALS
LOW PROFILE CERAMIC SURFACE MOUNT
ABM4A and ABM4B



FEATURES:

- 1.6 mm max. in height.
- Glass sealing assures high reliability.
- Suitable for reflow.

APPLICATIONS:

- Computers, Modems, Microprocessors.
- Communication, Test equipment.
- High density applications.

STANDARD SPECIFICATIONS

Frequency Range	10.00MHz - 100.00MHz
Operating Mode	10.00MHz ~ 32.00MHz (Fundamental) 28.00MHz ~ 100.00MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Fundamental	60 Ω max. for 10.0MHz ≤ F < 16.0MHz 50 Ω max. for 16.0MHz ≤ F ≤ 32.0MHz
3rd Overtone	60 Ω max. for 28.0MHz ≤ F < 34.0MHz 80 Ω max. for 34.0MHz ≤ F ≤ 100.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100 μW max.
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

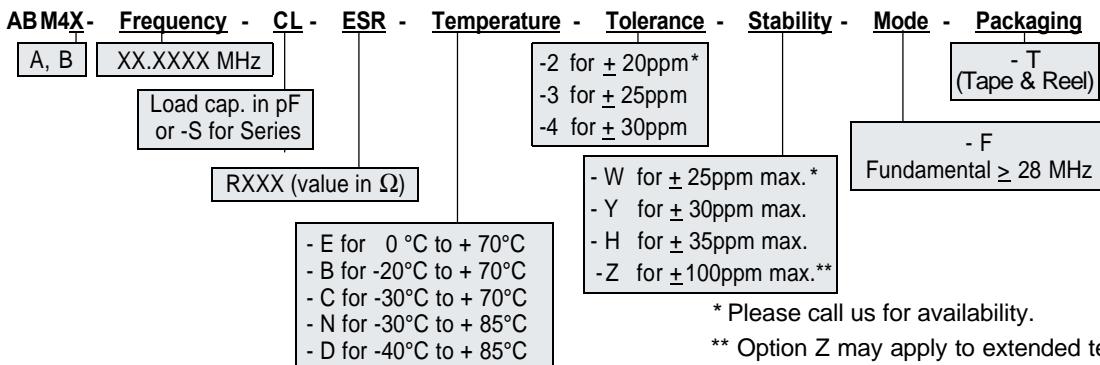
Environmental, and mechanical specifications, see appendix C, Group 2.

Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs/reel)

Recommended handling, see appendix F. Reflow profile, see appendix E.

Application notes, see appendix A.

ORDERING OPTIONS

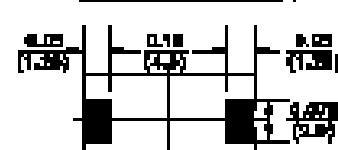
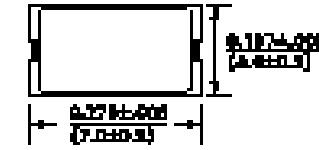


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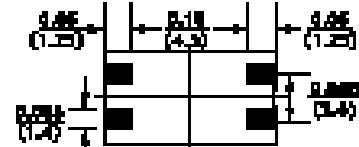
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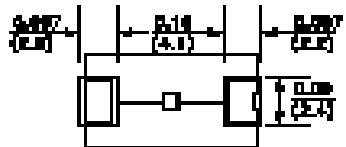


ABM4A

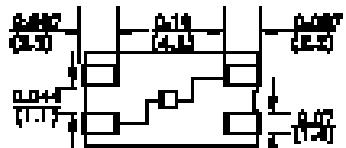


ABM4B

Recommended lead pattern



ABM4A

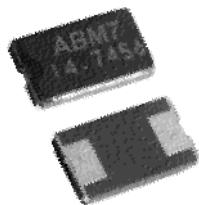


ABM4B

Dimensions: Inches (mm)

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6.0 x 3.5 x 1.3 mm

MICROPROCESSOR CRYSTALS MINIATURE LOW PROFILE CERAMIC SURFACE MOUNT **ABM7**

FEATURES:

- Low in height.(1.3 mm max.)
- Ceramic package assures high reliability.
- Small size SMD, suitable for high density applications.
- Superior heat-resistant glass sealing.

APPLICATIONS:

- Computers, Modems, Communication equipment.
- Thin equipment.

STANDARD SPECIFICATIONS

Frequency Range	10.00MHz - 50.00MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +70°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR)	60Ω max. for 10.0MHz ≤ F < 16.0MHz 50Ω max. for 16.0MHz ≤ F ≤ 50.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100μW max., 10μW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G.

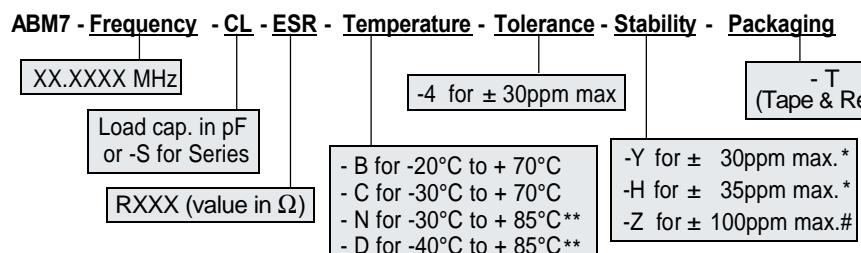
Tape and Reel, see appendix H.(1,000 pcs/reel)

Recommended handling, see appendix F.

Reflow profile, see appendix E.

Application notes, see appendix A.

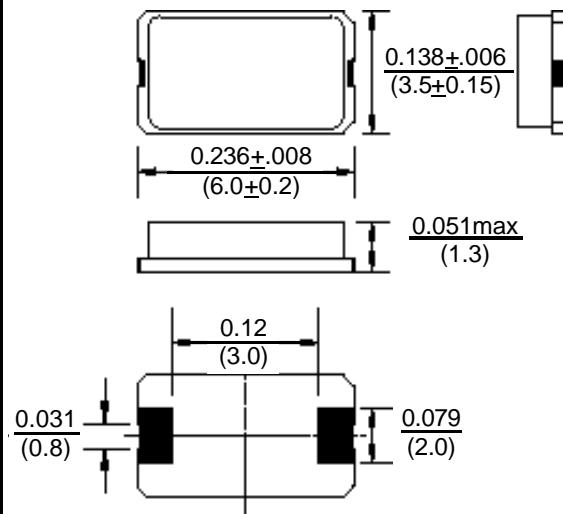
ORDERING OPTIONS



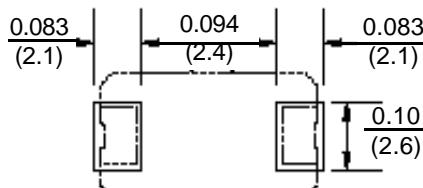
* standard temperature only.

** ± 100 ppm only.

Option Z may apply to extended temperatures.



Recommended land pattern



Dimensions: Inches (mm)

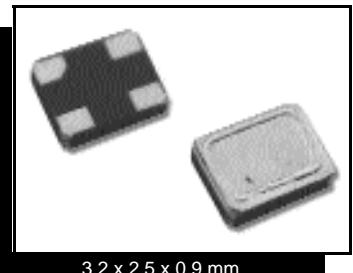
CONNECTIONS



MICROPROCESSOR CRYSTALS

ULTRA MINIATURE CERAMIC SURFACE MOUNT

ABM8



FEATURES:

- Low in height 0.9 max.; suitable for thin equipment.
- Ceramic package and metal lid assures high reliability.
- Tight tolerance and stability available.
- Suitable for solder reflow.
- High precision crystal, fundamental mode.

APPLICATIONS:

- High density applications.
- Modems, communication and test equipment.
- PMCIA, Wireless applications.

STANDARD SPECIFICATIONS

Frequency Range	16.000MHz - 60.000MHz
Operating Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Fundamental	300 Ω max. for 12.0 ≤ F < 14.0MHz 150 Ω max. for 14.0 ≤ F < 16.0MHz 100 Ω max. for 16.0 ≤ F < 20.0MHz 80 Ω max. for 20.0 ≤ F < 30.0MHz 50 Ω max. for 30.0 ≤ F ≤ 60.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100µW max., 10µW correlation
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

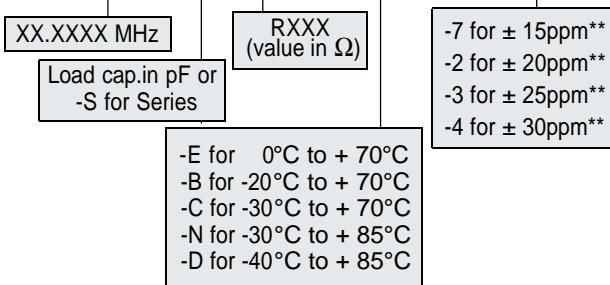
Tape and Reel, see appendix H.(1,000 pcs./reel)

Marking, appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS

ABM8 - Frequency - CL - ESR - Temperature - Tolerance - Stability - Packaging



Dimensions: Inches (mm)

* -10°C to +60°C only.

** Please call for availability.

Option Z may apply to extended temperatures.

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**MICROPROCESSOR CRYSTALS
ULTRA MINIATURE CERAMIC SURFACE MOUNT
ABM9**

4.0 x 2.5 x 0.8 mm

FEATURES:

- Ultra miniature size 4.0 x 2.5 x 0.8 mm max.
- Suitable for reflow.
- Ceramic package seam welded sealing assures high precision and reliability.

- Fundamental mode.
- Tight stability available.

APPLICATIONS:

- Blue-tooth, Wireless applications.
- Computers, Modems, Microprocessors.
- Communication, Test equipment.
- High density applications.
- PCMCIA.

STANDARD SPECIFICATIONS

Frequency Range	13.000MHz - 32.000MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +105°C
Frequency Tolerance @ 25°C	±20ppm max. (See Options)
Frequency Stability over Temp.	±20ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	80 Ω max. for 13.0MHz < F < 24.0MHz 60 Ω max. for 24.0MHz < F < 32.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100µW max., 10µW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

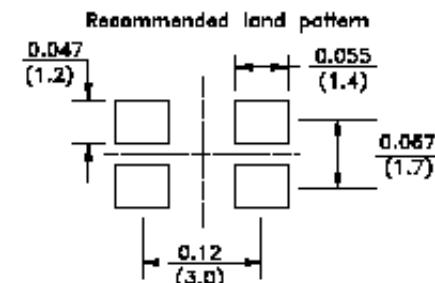
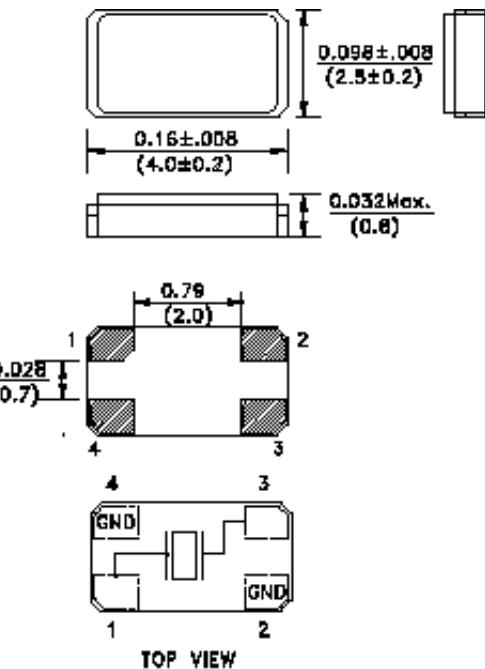
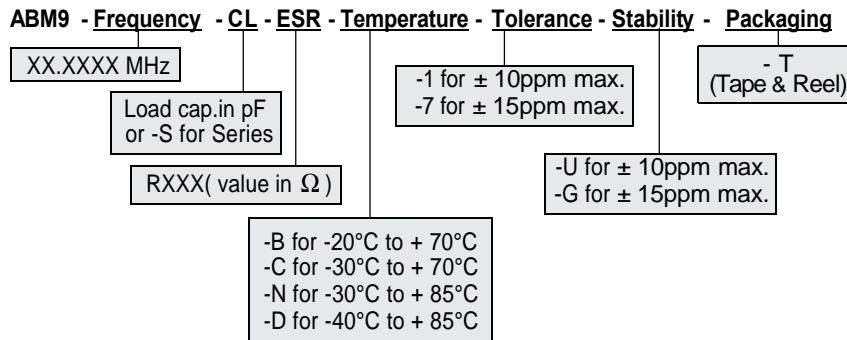
Environmental, and mechanical specifications, see appendix C. Group 2.

Tape and Reel, see appendix H.(1,000 pcs/reel)

Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS



Dimensions: Inches (mm)



MICROPROCESSOR CRYSTALS ULTRA MINIATURE CERAMIC SURFACE MOUNT ABM10

2.5 x 2.0 x 0.65 mm

FEATURES:

- Ultra miniature size 2.5 x 2.0 x 0.65 mm max.
- Suitable for reflow.
- Ceramic package and metal lid assures high precision and reliability.

- Fundamental mode.
- Tight stability available.

APPLICATIONS:

- Blue-tooth, Wireless applications.
- Computers, Modems, Microprocessors.
- Communication, Test equipment.
- High density applications.
- PCMCIA.

STANDARD SPECIFICATIONS

Frequency Range	20.000MHz - 60.000MHz
Operation Mode	Fundamental
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±20ppm max. (See Options)
Frequency Stability over Temp.	±30ppm max. (See Options)
Equivalent Series Resistance (ESR) Maximum	100 W max. for 20.0MHz < F < 30.0MHz 60 W max. for 30.0MHz < F ≤ 60.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	10pF (See Options)
Drive Level	200 μW max., 10μW correlation
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MW min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

Tape and Reel, see appendix H.(1,000 pcs/reel)

Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS

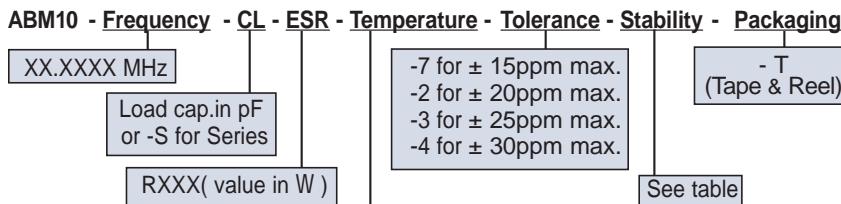


Table 1 Frequency Stability - VS - Temperature max.					
Temperature	±10ppm	±15ppm	±20ppm	±30ppm	±50ppm
0°C to +50°C	I10	I15	I20	I30	I50
-10°C to +60°C	x	A15	A20	STD	A50
-20°C to +70°C	x	x	E20	E30	E50
-30°C to +70°C	x	x	x	C30	C50
-40°C to +85°C	x	x	x	D30	D50
					D100

Please contact us for customized specifications

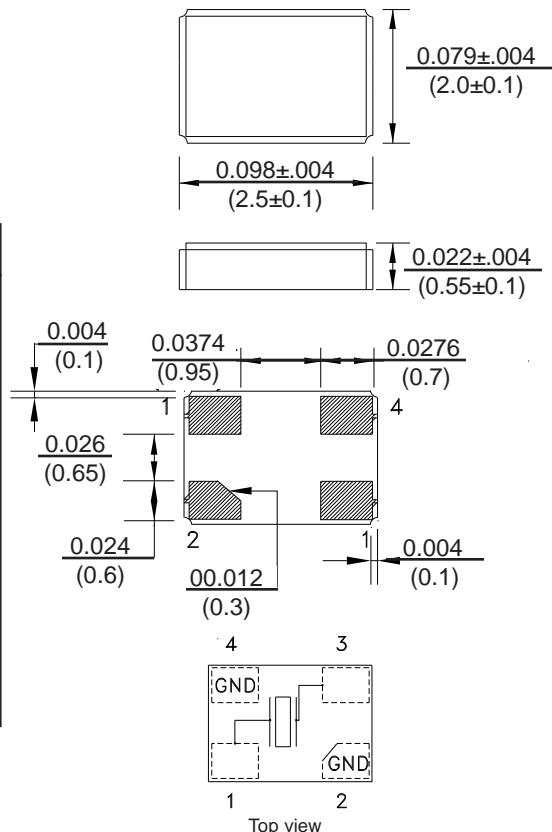


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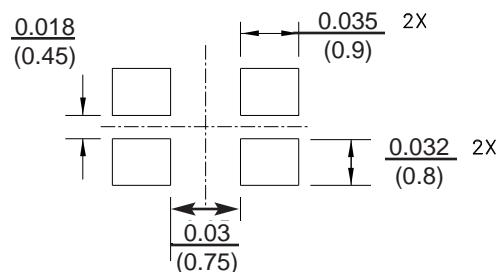
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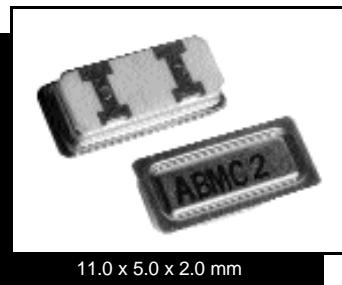
Recommended land pattern



Dimensions: Inches (mm)

(x) Please call for availability

MICROPROCESSOR CRYSTALS
CERAMIC SURFACE MOUNT MINIATURE
ABMC2



FEATURES:

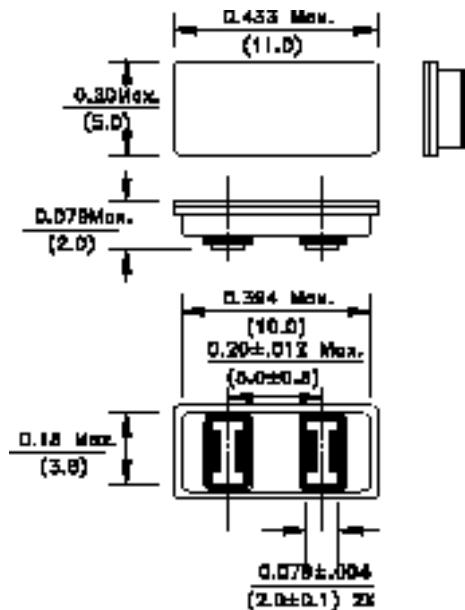
- 2.0 mm height.
- Resistance welded.
- Low frequency in true SMD package.
- High reliability; AT Strip cut for high-precision.
- Extended temperature available.
- Reflow capable.

APPLICATIONS:

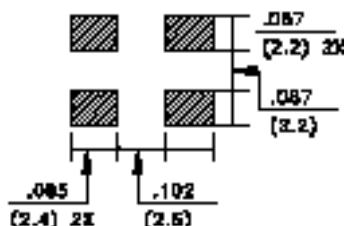
- PCMCIA applications.
- Microprocessors.
- Communication equipment, Networking, Thin equipment.

STANDARD SPECIFICATIONS

Frequency Range	3.579545MHz - 70MHz
Operation Mode	3.579545MHz ~ 27MHz (Fundamental) 27.0MHz ~ 41.0MHz (Fund. BT or AT) 27.01MHz ~ 70MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	$\pm 50\text{ppm}$ max. (See Options)
Frequency Stability over Temp.	$\pm 100\text{ppm}$ max. (See Options)
Equivalent Series Resistance (ESR)	200 Ω max. for $3.57\text{MHz} \leq F < 4.00\text{MHz}$ 150 Ω max. for $4.00\text{MHz} \leq F < 5.00\text{MHz}$ 120 Ω max. for $5.00\text{MHz} \leq F < 6.00\text{MHz}$ 100 Ω max. for $6.00\text{MHz} \leq F < 7.00\text{MHz}$ 80 Ω max. for $7.00\text{MHz} \leq F < 9.00\text{MHz}$ 60 Ω max. for $9.00\text{MHz} \leq F < 12.00\text{MHz}$ 50 Ω max. for $12.00\text{MHz} \leq F < 20.00\text{MHz}$ 40 Ω max. for $20.00\text{MHz} \leq F \leq 27.00\text{MHz}$ 40 Ω max. for $27.00\text{MHz} \leq F \leq 41.00\text{MHz}$
AT Fundamental	100 Ω max. for $27.01\text{MHz} \leq F \leq 70.00\text{MHz}$
AT or BT Fundamental	
3rd Overtone	
Shunt Capacitance C_0	7pF max.
Load Capacitance C_L	18pF (See Options)
Drive Level	100 μW max.
Aging @ 25°C per Year	$\pm 5\text{ppm}$ max.
Insulation Resistance	500M Ω min. at 100Vdc $\pm 15\text{V}$



Recommended Land Pattern



Dimensions: Inches (mm)

CONNECTIONS



ORDERING OPTIONS

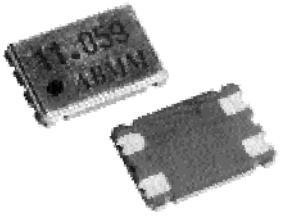
ABMC2 - Frequency	- CL	- ESR	- Temperature	- Tolerance	- Stability	- Mode	- Packaging
XX.XXXX MHz		RXXX (value in Ω)		-1 for $\pm 10\text{ppm}$ -7 for $\pm 15\text{ppm}$ -2 for $\pm 20\text{ppm}$ -3 for $\pm 25\text{ppm}$ -4 for $\pm 30\text{ppm}$	-U for $\pm 10\text{ppm}$ -G for $\pm 15\text{ppm}$ -X for $\pm 20\text{ppm}$ -W for $\pm 25\text{ppm}$ -Y for $\pm 30\text{ppm}$ -H for $\pm 35\text{ppm}$ -Z for $\pm 50\text{ppm}$		- T (Tape & Reel)
Load cap. in pF (10pF min.) or -S for Series	-E for 0°C to +70°C -B for -20°C to +70°C -C for -30°C to +70°C -N for -30°C to +85°C -D for -40°C to +85°C					- F (Fundamental AT > 27MHz) - FB (Fundamental BT > 27MHz)	

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7.0 x 5.0 x 1.3 mm

MICROPROCESSOR CRYSTALS CERAMIC SURFACE MOUNT MINIATURE ABMM and ABMM1

FEATURES:

- Low in height; (1.1 mm) suitable for thin equipment.
- AT strip cut offering a tight tolerance and stability.
- Ceramic package assures high reliability.
- Suitable for solder reflow.
- Ceramic lid option (-K) See Note.

APPLICATIONS:

- PCMCIA applications. • Suitable for thin equipment.

STANDARD SPECIFICATIONS

Frequency Range	8.000MHz - 125MHz (See note)
Operation Mode	8.0MHz ~ 33MHz (Fundamental) 33.01MHz ~ 125MHz (3rd overtone)
Operating Temperature	-10°C to + 60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options) ±100ppm max. @ -10°C to +60°C (FB)
Equivalent Series Resistance (ESR) Fundamental	70 Ω max. for 8.0MHz ≤ F < 12.0MHz 50 Ω max. for 12MHz ≤ F < 20.0MHz 40 Ω max. for 20.0MHz ≤ F ≤ 33.0MHz
3rd Overtone	80 Ω max. for 33.0MHz < F ≤ 125MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	500μW max, 100μW correlation
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance:	500M Ω min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

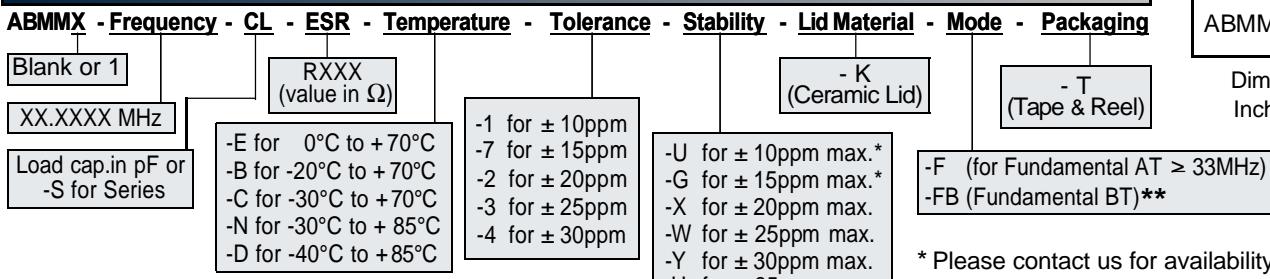
Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs/reel)

Reflow profile, see appendix E. Recommended handling, see appendix F.

Application notes, see appendix A.

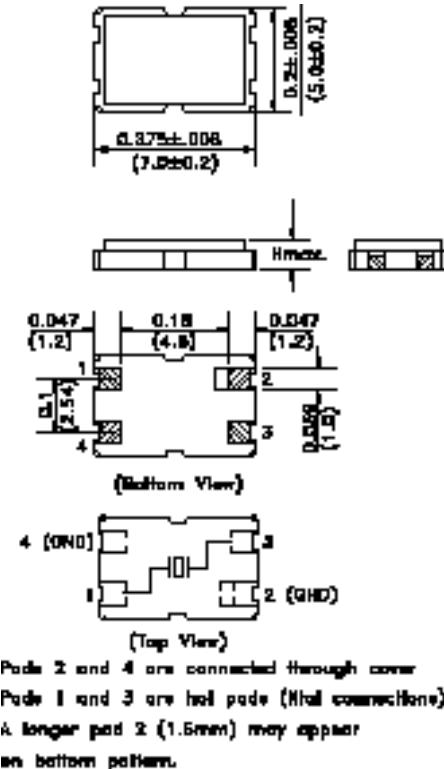
Note: Please contact us for availability above 100MHz

ORDERING OPTIONS

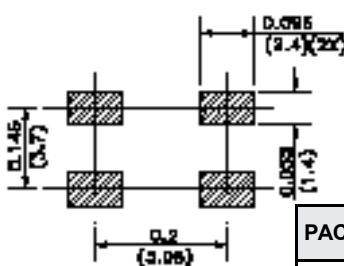


Contact us for tighter tolerance and stability.

Certain restrictions apply on selected frequencies and frequency stabilities.



Recommended Land Pattern



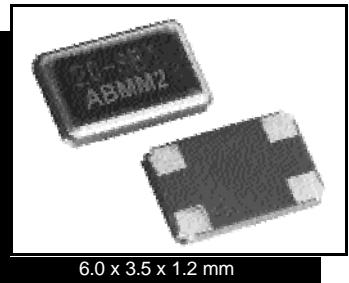
PACKAGE	H MAX.
ABMM	0.052 (1.3)
ABMM1	0.043 (1.1)

Dimensions:
Inches (mm)

* Please contact us for availability.

** ±100ppm max. stability
from -10°C. to 60°C only.

HIGH PRECISION CRYSTALS SURFACE MOUNT CERAMIC LOW PROFILE **ABMM2**



FEATURES:

- Low in height.(1.2 mm)
- Tight tolerance and stability available.
- Seam welded ceramic package.
- Suitable for solder reflow.
- Wide frequency range.
- High precision crystal.

APPLICATIONS:

- PCMCIA applications.
- Suitable for thin equipment.

STANDARD SPECIFICATIONS

Frequency Range	12.800MHz - 110MHz
Operation Mode	12.800MHz ~ 30MHz (Fundamental) 30.01MHz ~ 100MHz (3rd overtone) 90.00MHz ~ 110MHz (5th overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±20ppm max. (See Options)
Frequency Stability over Temp.	±20ppm max. (See Table 1 below)
Equivalent Series Resistance (ESR)	Fundamental 50 Ω max. for 12.8MHz \leq F \leq 30.0MHz 3rd overtone 60 Ω max. for 30.0MHz < F \leq 90.0MHz 5th overtone 80 Ω max. for 90.0MHz < F \leq 110.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	500μW max., 100μW correlation
Aging @ 25°C per Year	±2ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs/reel)

Reflow profile, see appendix E. Recommended handling, see appendix F.

Application notes, see appendix A.

ORDERING OPTIONS

ABMM2 - Frequency	- CL -	- ESR	- Tolerance	- Temperature and Stability	- Mode	- Packaging
XX.XXXX MHz			-1 for ± 10ppm max -7 for ± 15ppm max		- F = Fundamental AT > 30MHz -FB = Fundamental BT > 30MHz - O = 3rd Overtone ≥ 90MHz	- T (Tape & Reel)
Load cap. in pF (10pF min.) or -S for Series	RXXX	(value in Ω)				

TABLE 1 Frequency -vs.- Temperature

TEMPERATURE RANGE °C	± 4 ppm max.	± 5 ppm max.	± 10 ppm max.	± 20 ppm max.
0°C to +50°C	Option - A1	Option - A2	Option - A3	Option - A4
-10°C to +50°C	Option - B1	Option - B2	Option - B3	Option - B4
-10°C to +60°C		Option - C2	Option - C1	Standard
-20°C to +70°C			Option - E1	Option - E2
-40°C to +85°C				Option - D1

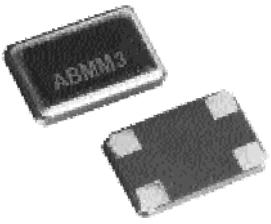
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6.0 x 3.5 x 1.3 mm

MICROPROCESSOR CRYSTALS SURFACE MOUNT CERAMIC LOW PROFILE **ABMM3**

FEATURES:

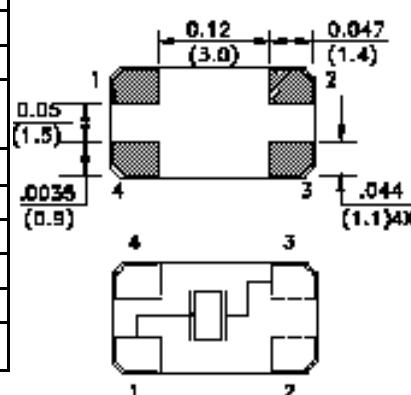
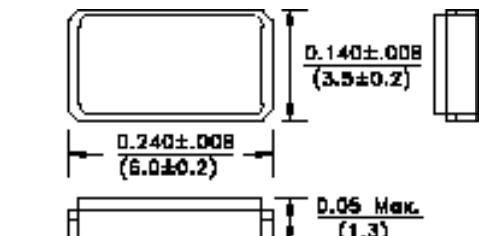
- Low in height; (1.3 mm) suitable for thin equipment.
- Superior heat-resistant glass sealing
- Wide frequency range.
- Suitable for solder reflow.

APPLICATIONS:

- PCMCIA applications.
- Suitable for thin equipment.

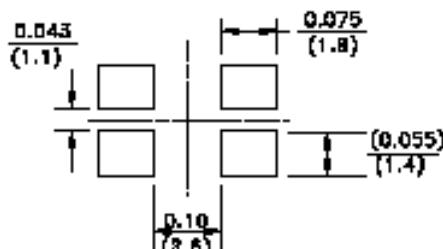
STANDARD SPECIFICATIONS

Frequency Range	13.0MHz - 120.0MHz
Operation Mode	13.00MHz ~ 40MHz (Fundamental) 40.01MHz ~ 120MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR) Fundamental	80 Ω max. for 13.00MHz ≤ F ≤ 20.0MHz 50 Ω max. for 20.0MHz < F ≤ 40.0MHz
3rd Overtone	100 Ω max. for 40.0MHz < F ≤ 120.0MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100µW max
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance:	500M Ω min. at 100Vdc ±15V



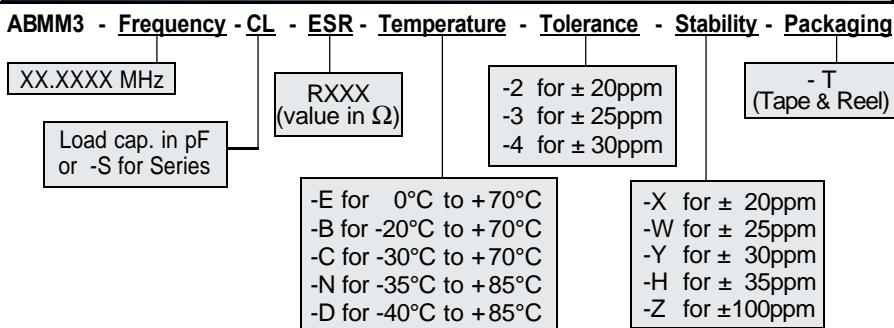
TOP VIEW

Recommended land pattern



Dimensions: Inches (mm)

ORDERING OPTIONS



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MICROPROCESSOR CRYSTALS

MOLDED PLASTIC SURFACE MOUNT

ABSM



FEATURES:

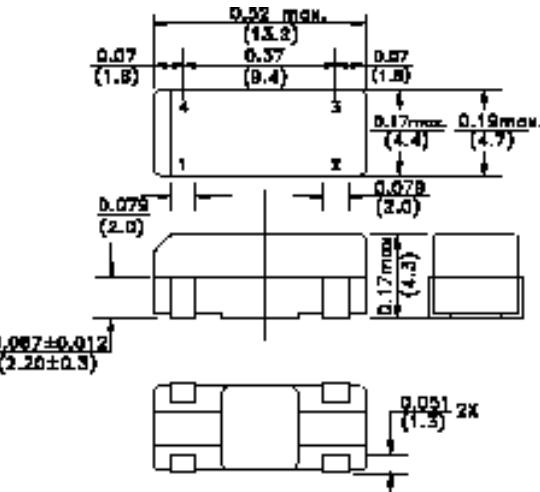
- Wide frequency range.
- Economical surface mount design.
- Excellent heat resistance.
- Suitable for solder reflow.

APPLICATIONS:

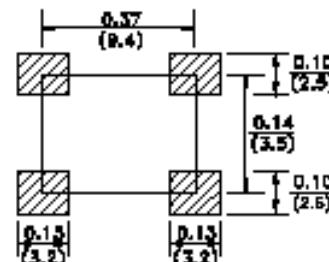
- Communication equipment.
- Measuring instruments.
- A / V equipment.

STANDARD SPECIFICATIONS

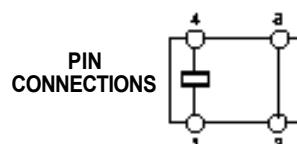
Frequency Range	3.57MHz - 70MHz
Operation Mode	3.57MHz ~ 25MHz (Fundamental) 25.01MHz ~ 45MHz (Fund. BT or AT) 30.0MHz ~ 70MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40° to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±100ppm max. (See Options)
Equivalent Series Resistance (ESR)	200Ω max. for 3.57MHz ≤ F < 4.0MHz 150Ω max. for 4.0MHz ≤ F < 5.0MHz 120Ω max. for 5.0MHz ≤ F < 6.0MHz 100Ω max. for 6.0MHz ≤ F < 7.0MHz 80Ω max. for 7.0MHz ≤ F < 9.0MHz 60Ω max. for 9.0MHz ≤ F < 13.0MHz 40Ω max. for 13.0MHz ≤ F ≤ 45.0MHz
Fundamental	100Ω max. for 30.0MHz ≤ F ≤ 70MHz
3rd Overtone	100Ω max. for 30.0MHz ≤ F ≤ 70MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	100µW max.
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V



Recommended land pattern



Dimensions: Inches (mm)



Environmental, and mechanical specifications, see appendix C. Group 2.
Marking, see appendix G. Recommended handling, see appendix F.
Tape and Reel, see appendix H.(1,000 pcs/reel)
Reflow profile, see appendix E. Application notes, see appendix A.

ORDERING OPTIONS

ABSM - Frequency - CL	ESR	Temperature	Tolerance	Stability	Mode	Packaging
XX.XXXX MHz	RXXX (value in Ω)			-Z for ± 50ppm		-T (Tape & Reel)
Load cap. in pF or -S for Series						
		-E for 0°C to +70°C -B for -20°C to +70°C -C for -30°C to +70°C -N for -30°C to +85°C -D for -40°C to +85°C	-3 for ± 25ppm -4 for ± 30ppm	- F (Fundamental AT ≥ 30MHz) - FB (Fundamental BT ≥ 30MHz)		

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12.5 x 4.6 x 3.7 mm

MICROPROCESSOR CRYSTALS MOLDED PLASTIC SURFACE MOUNT **ABSM2**

FEATURES:

- Wide frequency range.
- Economical surface mount design.
- Plastic molded package incorporated cylindrical-type crystal.
- Excellent heat resistance.
- Suitable for solder reflow.

APPLICATIONS:

- Communication equipment.
- Measuring instruments.
- A/V equipment.
- High-density circuit boards.

STANDARD SPECIFICATIONS

Frequency Range	3.50MHz - 70MHz
Operation Mode	3.50MHz ~ 32MHz (Fundamental) 30MHz ~ 70MHz (3rd overtone)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-55°C to +125°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±50ppm max. (See Options)
Equivalent Series Resistance (ESR)	200 Ω max. for 3.5MHz ≤ F < 4.00MHz 150 Ω max. for 4.0MHz ≤ F < 6.00MHz 100 Ω max. for 6.0MHz ≤ F < 12.0MHz 50 Ω max. for 12.0MHz ≤ F < 32.0MHz
Fundamental AT	100 Ω max. for 30.0MHz ≤ F < 36.0MHz 80 Ω max. for 36.0MHz ≤ F ≤ 70.0MHz
3rd Overtone	
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	16pF (See Options)
Drive Level	100μW max.
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G.

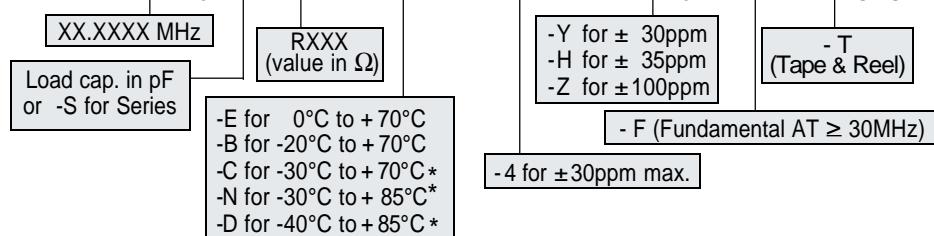
Tape and Reel, see appendix H.(2,000 pcs/reel).

Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS

ABSM2 - Frequency - CL - ESR - Temperature - Tolerance - Stability - Mode - Packaging



*Frequency Stability may vary depending on frequency.

**MICROPROCESSOR CRYSTALS
AT 49 CASE GROUNDED (- G), SURFACE MOUNT
ABSM3 Series**



FEATURES:

- Excellent all-purpose surface-mount crystal.
- Two different pin connections.
- Four pad land pattern compatible with common plastic molded designs.
- Case ground on AG series.

APPLICATIONS:

- Modems, Communications, High-density equipment
- Low EMI applications, Noise reductions.

STANDARD SPECIFICATIONS

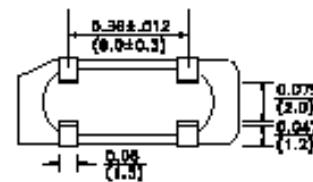
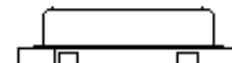
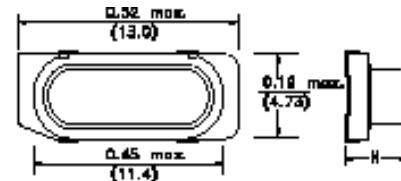
Frequency Range	3.579MHz - 60MHz
Operation Mode	3.579MHz - 28MHz (Fundamental) 28.01MHz - 60MHz (3rd overtone) (Fundamental Frequency up to 50MHz)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40°C to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±100ppm max. (See Options)
Equivalent Series Resistance (ESR) Fundamental	180 Ω max. for 3.579MHz ≤ F < 4.000MHz 150 Ω max. for 4.000MHz ≤ F < 5.000MHz 100 Ω max. for 5.000MHz ≤ F < 7.000MHz 50 Ω max. for 7.000MHz ≤ F < 15.00MHz 40 Ω max. for 15.00MHz ≤ F ≤ 50.00MHz
3rd Overtone	100 Ω max. for 28.0MHz < F ≤ 60.00MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	1mW max., 100μW correlation
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications see appendix C, Group 1.

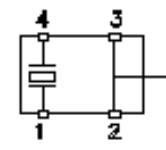
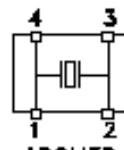
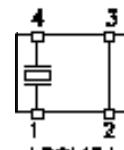
Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs/reel).

Reflow profile, see appendix E. Recommended handling, see appendix F.

Application notes, see appendix A.



Electrode arrangement



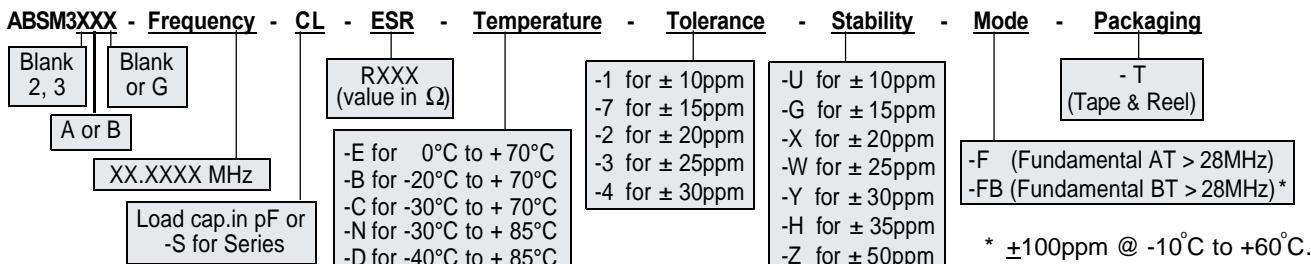
Connect
to Case/GND

PIN CONNECTIONS

Dimensions:
Inches (mm)

Part Number	H (max.)
ABSM3A	0.20 (5.1)
ABSM32A	0.18 (4.5)
ABSM33A	0.15 (3.8)
ABSM3B	0.20 (5.1)
ABSM32B	0.18 (4.5)
ABSM33B	0.15 (3.8)
ABSM3AG	0.20 (5.1)
ABSM32AG	0.18 (4.5)

ORDERING OPTIONS



* ±100ppm @ -10°C to +60°C.

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MICROPROCESSOR CRYSTALS AT49 CASE GROUNDED (-G), SURFACE MOUNT ABSM5 Series

13.0 x 5.0 x 5.1 mm

FEATURES:

- Excellent all-purpose surface-mount crystal, 4.88 mm lead spacing.
- Case ground option on G series.
- Four pad land pattern compatible with common ceramic package.

APPLICATIONS:

- Modems, Communications, High-density equipment.

STANDARD SPECIFICATIONS

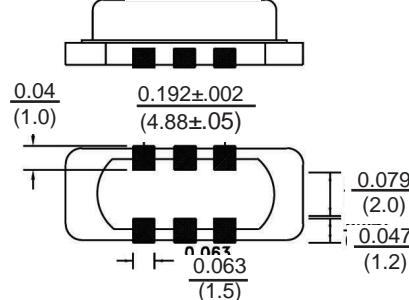
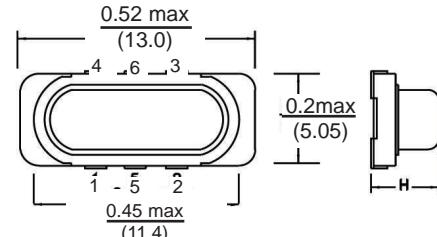
Frequency Range	3.579MHz - 60MHz
Operation Mode	3.579MHz - 28MHz (Fundamental) 28.01MHz - 60MHz (3rd overtone) (Fundamental Frequency up to 50MHz)
Operating Temperature	-10°C to +60°C (See Options)
Storage Temperature	-40° to +85°C
Frequency Tolerance @ 25°C	±50ppm max. (See Options)
Frequency Stability over Temp.	±100ppm max. (See Options)
Equivalent Series Resistance (ESR) Fundamental	180 W max. for 3.579MHz ≤ F < 4.000MHz 150 W max. for 4.000MHz ≤ F < 5.000MHz 100 W max. for 5.000MHz ≤ F < 7.000MHz 50 W max. for 7.000MHz ≤ F < 15.00MHz 40 W max. for 15.00MHz ≤ F ≤ 50.00MHz
3rd Overtone	100 W max. for 28.0MHz < F ≤ 60.00MHz
Shunt Capacitance C ₀	7pF max.
Load Capacitance C _L	18pF (See Options)
Drive Level	1mW max., 100µW correlation
Aging @ 25°C per Year	±5ppm max.
Insulation Resistance	500M W min. at 100Vdc ±15V

Environmental, and mechanical specifications, see appendix C. Group 1.

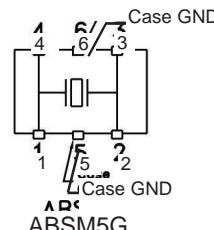
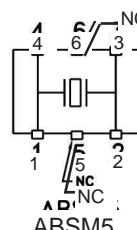
Marking, see appendix G. Tape and Reel, see appendix C.(1,000 pcs/reel)

Reflow profile, see appendix E. Recommended handling, see appendix F.

Application notes, see appendix A.



Electrode arrangement



Dimensions: Inches (mm)

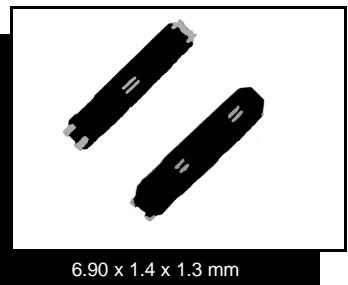
Part Number	H (max.) inch.(mm)
ABSM5	0.2 (5.1)
ABSM52	0.18 (4.5)
ABSM53	0.15 (3.8)
ABSM5G	0.2 (5.1)
ABSM52G	0.18 (4.5)

ORDERING OPTIONS

ABSM5X X - Frequency - CL - ESR - Temperature - Tolerance - Stability - Mode - Packaging									
<table border="1"> <tr> <td>Blank 2 or 3</td> <td>Blank or G</td> <td>XX.XXXX MHz</td> <td>Load cap.in pF or -S for Series</td> <td>RXXX (value in W)</td> <td>-E for 0°C to + 70°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C</td> <td>-H5 for ± 5ppm** -1 for ± 10ppm -7 for ± 15ppm -2 for ± 20ppm -3 for ± 25ppm -4 for ± 30ppm</td> <td>-R5 for ± 5ppm** -U for ± 10ppm -G for ± 15ppm -X for ± 20ppm -W for ± 25ppm -Y for ± 30ppm -H for ± 35ppm -Z for ± 50ppm</td> <td>-T (Tape & Reel) -F (Fundamental AT > 28MHz) -FB (Fundamental BT > 28MHz)*</td> </tr> </table>	Blank 2 or 3	Blank or G	XX.XXXX MHz	Load cap.in pF or -S for Series	RXXX (value in W)	-E for 0°C to + 70°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C	-H5 for ± 5ppm** -1 for ± 10ppm -7 for ± 15ppm -2 for ± 20ppm -3 for ± 25ppm -4 for ± 30ppm	-R5 for ± 5ppm** -U for ± 10ppm -G for ± 15ppm -X for ± 20ppm -W for ± 25ppm -Y for ± 30ppm -H for ± 35ppm -Z for ± 50ppm	-T (Tape & Reel) -F (Fundamental AT > 28MHz) -FB (Fundamental BT > 28MHz)*
Blank 2 or 3	Blank or G	XX.XXXX MHz	Load cap.in pF or -S for Series	RXXX (value in W)	-E for 0°C to + 70°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C	-H5 for ± 5ppm** -1 for ± 10ppm -7 for ± 15ppm -2 for ± 20ppm -3 for ± 25ppm -4 for ± 30ppm	-R5 for ± 5ppm** -U for ± 10ppm -G for ± 15ppm -X for ± 20ppm -W for ± 25ppm -Y for ± 30ppm -H for ± 35ppm -Z for ± 50ppm	-T (Tape & Reel) -F (Fundamental AT > 28MHz) -FB (Fundamental BT > 28MHz)*	

** Please contact us for availability.

**ULTRA LOW PROFILE, 32.768kHz CRYSTALS
MOLDED PLASTIC SURFACE MOUNT
ABS13**



FEATURES:

- Small SMD type, 1.3 mm height.
- Suitable for reflow soldering.
- Heat resistant packaging.

APPLICATIONS:

- Ideal for high-density circuit application.
- Clock source for communications equipment, Measuring instruments.
- Real time clock.
- Blue tooth applications.

STANDARD SPECIFICATIONS

Frequency Range	32.768kHz
Operation Mode	Fundamental
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +125°C
Frequency Tolerance @ 25°C	±20ppm max.
Frequency Stability over Temp.	-0.034 ±0.006ppm / (25-T) ²
Turnover Temperature	25°C ±5°C
Equivalent Series Resistance (ESR)	65kΩ max.
Motional Capacitance C ₁	0.0023pF typ.
Load Capacitance C _L	12.5pF (See Options)
Drive Level	1μW max.
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications see appendix C. Group 7.
Marking, see appendix G.

Tape and Reel, see appendix H. (3,000 pcs./reel)

Reflow profile, see appendix E.

Recommended handling, see appendix F.

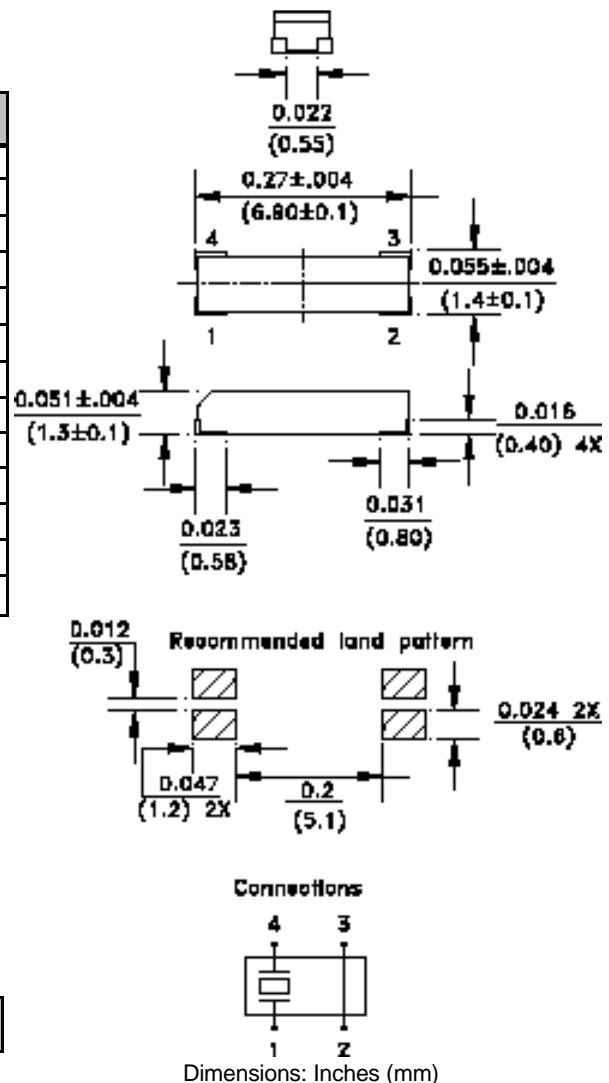
Application notes, see appendix A.

ORDERING OPTIONS

ABS13 - 32.768 kHz - CL - Packaging

Load cap. in pF

- T (Tape & Reel)



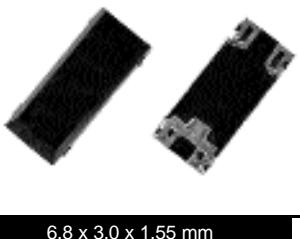
Dimensions: Inches (mm)

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LOW PROFILE, 32.768kHz CRYSTALS MOLDED PLASTIC SURFACE MOUNT **ABS15**

6.8 x 3.0 x 1.55 mm

FEATURES:

- Small SMD type, 1.55 mm height.
- Suitable for reflow soldering.
- Heat resistant packaging.

APPLICATIONS:

- Ideal for high-density circuit application.
- Clock source for communications equipment, Measuring instruments.
- Real time clock.

STANDARD SPECIFICATIONS

Frequency Range	32.768kHz
Operation Mode	Fundamental
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +125°C
Frequency Tolerance @ 25°C	±20ppm max.
Frequency Stability over Temp.	-0.034 ±0.006ppm / (25-T) ²
Turnover Temperature	25°C ±5°C
Equivalent Series Resistance (ESR)	65kΩ max.
Motional Capacitance C ₁	0.003pF typ.
Load Capacitance C _L	12.5pF (See Options)
Drive Level	1µW max.
Aging @ 25°C First Year	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15V

Environmental, and mechanical specifications see appendix C. Group 7.

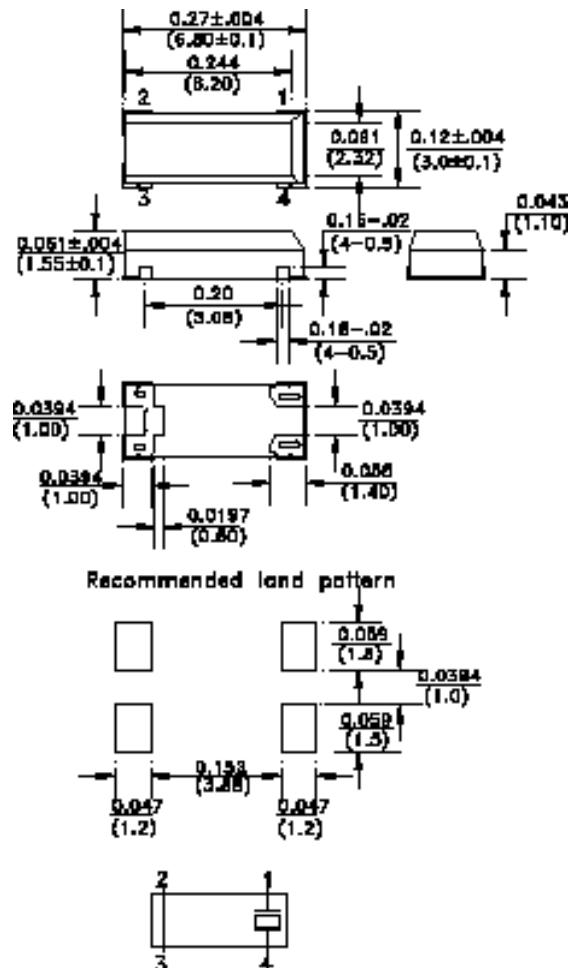
Marking, see appendix G.

Tape and Reel, see appendix H.(3,000 pcs./reel)

Reflow profile, see appendix E.

Recommended handling, see appendix F.

Application notes, see appendix A.



Dimensions: Inches (mm)

ORDERING OPTIONS

ABS15 - 32.768 kHz - CL - Packaging
 Load cap. in pF - T (Tape & Reel)

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LOW PROFILE, kHz FREQUENCY CRYSTALS MOLDED PLASTIC SURFACE MOUNT **ABS25**



FEATURES:

- Perfect for SMT applications with limited space.
- Low power consumption ideal for portable equipment.
- Low profile 2.5 mm.
- Plastic molded package with internal tubular type quartz crystal.
- Excellent heat resistance.
- Reflow capable.
- Watch frequency.

APPLICATIONS:

- Clock source for communication or A/V equipment, Measuring instruments.
- Real time clock.

STANDARD SPECIFICATIONS

Standard Frequency Range	32.768kHz	30kHz - 165kHz
Operating Temperature	-40°C to +85°C	
Storage Temperature	-55°C to +125°C	
Frequency Tolerance @ 25°C	±20ppm max. (See Options)	±30ppm max.(See Options)
Frequency Stability over Temp.	-0.034 ±0.006ppm / (25-T) ² (See Note)	
Turnover Temperature	25°C ±5°C	
Equivalent Series Resistance (ESR)	50kΩ max.	30kΩ max. to 50kΩ max.
Shunt Capacitance C ₀	1.35pF max.	0.8 ~ 1.7pF typ.
Motional Capacitance C ₁	0.003pF typ.	0.001 ~ 0.004pF typ.
Load Capacitance C _L	12.5pF (See Options)	
Capacitance Ratio C ₀ /C ₁	450 typical	425 ~ 800 typical
Drive Level	1µW max.	
Aging (Per Year)	±3ppm max.	±5ppm max.
Insulation Resistance	500MΩ min. at 100Vdc ±15 V	

NOTE: Example; Stability at -20°C is: $-0.034 \times (25-[-20])^2 = -68.8\text{ppm}$.

Environmental, and mechanical specifications, see appendix C. Group 7.

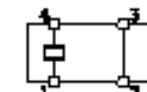
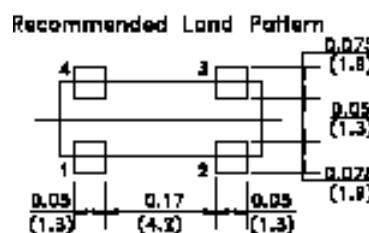
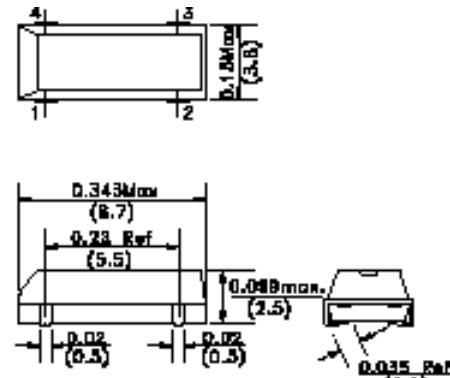
Marking, see appendix G.

Tape and Reel, see appendix H.(3,000 pcs/reel)

Reflow profile, see appendix E.

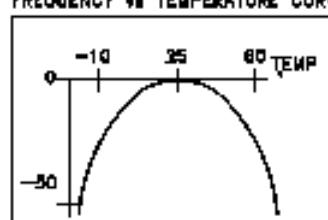
Recommended handling, see appendix F.

Application notes, see appendix A.



Dimensions: Inches (mm)

FREQUENCY vs TEMPERATURE CURVE



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6.0 x Ø2.0 mm

LOW FREQUENCY, REFLOWABLE, CYLINDRICAL TYPE CRYSTALS TUNING FORK SURFACE MOUNT AB26TR Series

FEATURES:

- Excellent shock resistance.
- Formed leads for low cost SMD type.
- Frequency from 30kHz to 165kHz.
- Reflow capable.

APPLICATIONS:

- Real-time clock.
- Measuring instruments.
- Blue-tooth and wireless applications.
- Clock source for communication.

STANDARD SPECIFICATIONS

Frequency Range	32.768kHz	
30kHz to 165kHz	Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C	
Turnover Temperature	25°C to ±5°C	
Frequency Tolerance @ 25C	±20ppm max.	±30ppm max.
Frequency Stability over Temp	-0.034 ± 0.006ppm / (25-T) ² (See Note)	
Equivalent Series Resistance (ESR)	35kΩ max.	35kΩ to 50kΩ max.
Shunt Capacitance C ₀	1.35pF typical	0.8pF to 1.7pF
Load Capacitance C _L	12.5pF (See Options)	
Motion Capacitance C ₁	0.003pF typ.	0.001pF-0.004pF
Capacitance ratio	450 typ.	425 to 800 typ.
Drive Level	1μW max.	
Aging @ 25°C per year	±5ppm max.	

NOTE: Example; Stability at -20°C is: $-0.034 \times (25 - [-20])^2 = -68.8\text{ppm}$.

Environmental, and mechanical specifications, see appendix C.

Tape and Reel, (2,000pcs/reel), appendix H.

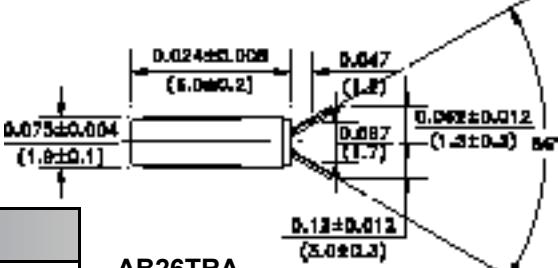
Marking, see appendix G.

Application notes, see appendix A.

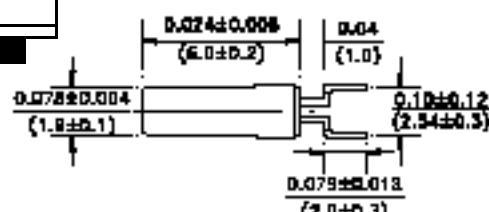
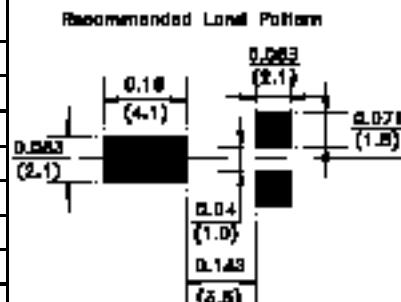
Recommended handling, see appendix F.

ORDERING OPTIONS

AB26TRX	- Frequency	- CL	- Tolerance	- Packaging
A or B	Load cap in pF		- T(Tape & Reel)	
XX.XXXX kHz			- 1 for ±10ppm max.	
			- 7 for ±15ppm max.	

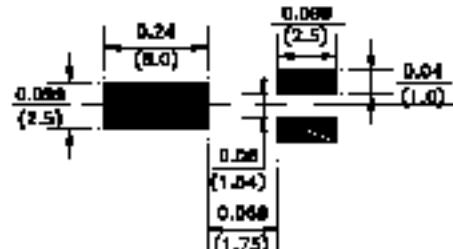


AB26TRA



AB26TRB

Recommended Land Pattern



Dimensions: Inches (mm)

**HIGH FREQUENCY, CYLINDRICAL TYPE CRYSTALS
REFLOWABLE SURFACE MOUNT
AB308R and AB310R**



FEATURES:

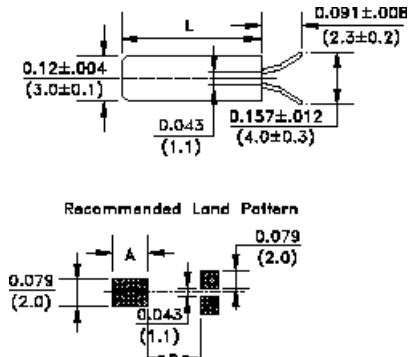
- Miniature High-Frequency crystals.
- Reflow capable.
- Excellent vibration, Shock resistant.

APPLICATIONS:

- Wide range of applications.
- Communications, Measuring instruments.
- Microprocessor clocks.
- Ideal for low cost SMD applications.

STANDARD SPECIFICATIONS

PARAMETERS	AB308R	AB310R
Frequency Range	4.001MHz - 70MHz	3.5MHz-4.000MHz
Operation Mode	4.001MHz - 32.0MHz (Fund.) 30.0MHz - 70.0MHz (3rd OT)	Fundamental
Operating Temperature	-10°C to +60°C (See Options)	
Storage Temperature	-40°C to +85°C	
Frequency Tolerance @ 25°C	±30ppm max. (See Options)	
Frequency Stability over Temp.	±50ppm max. (See Options)	
Equivalent Series Resistance (ESR)		
Fundamental	150Ω max. for 4.0MHz ≤ F < 6.0MHz 100Ω max. for 6.0MHz ≤ F < 10.0MHz 50Ω max. for 10.0MHz ≤ F ≤ 32.0MHz	200Ω max.
3rd Overtone	100Ω max. for 30.0MHz ≤ F < 36.0MHz 80Ω max. for 36.0MHz ≤ F ≤ 70.0MHz	
Shunt Capacitance C ₀	5pF max.	
Load Capacitance C _L	16pF typical (See Options)	
Drive Level	100µW max.	
Aging @ 25°C First Year	±5ppm max.	
Insulation Resistance	500MΩ min. at 100Vdc ±15V	



Dimensions: Inches (mm)

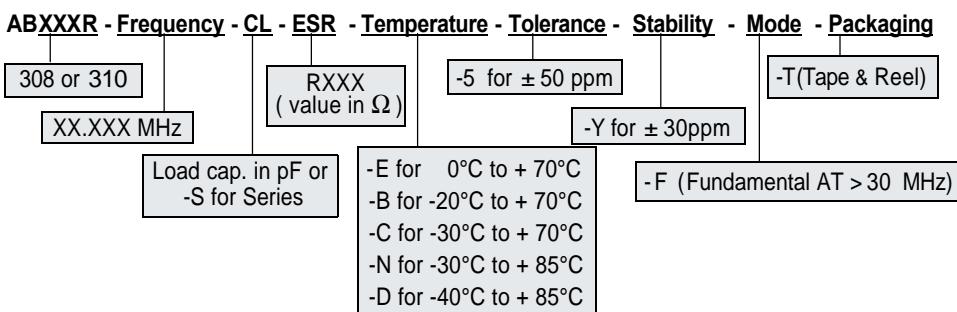
Environmental, and mechanical specifications, see appendix C. Group 3.

Tape and Reel, see appendix H.(2,000 pcs/reel)

Marking, see appendix G. Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS



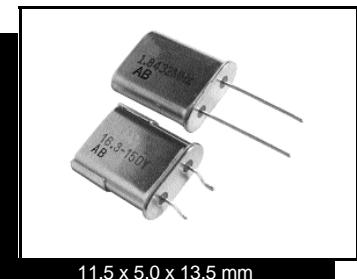
Dim.	AB308R	AB310R
L	0.346±0.012 (8.8±0.3)	0.386±0.008 (9.8±0.2)
A	0.178 (4.5)	0.2 (5.01)
B	0.23 (5.81)	0.25 (6.31)

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MICROPROCESSOR CRYSTALS WIDE FREQUENCY RANGE • LOW COST • HC49/U

AB

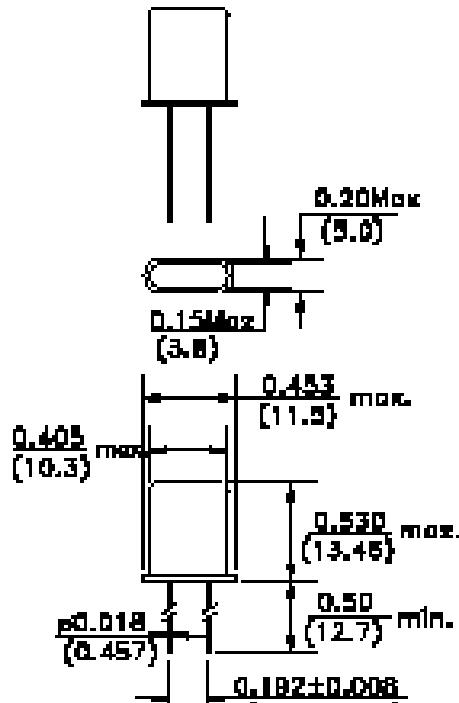
11.5 x 5.0 x 13.5 mm

FEATURES:

- Height 13.5 mm.
- High precision availability.
- Resistance welded.
- Good for high pullability.

STANDARD SPECIFICATIONS

Frequency Range	850kHz - 1.500MHz (HC 51/U) * 1.0MHz & 1.8432MHz - 160MHz (HC49/U)
Operation Mode	850KHz \leq F \leq 50.0MHz (Fundamental) 24.0MHz < F \leq 66.0MHz (3rd OT) 66.0MHz < F \leq 122MHz (5th OT) 122.0MHz < F \leq 160MHz (7th OT)
Operating Temperature	0°C to +70°C (See Options)
Storage Temperature	-55°C to +125°C
Frequency Tolerance @ 25°C	\pm 50ppm max. (See Options)
Frequency Stability over Temp.	\pm 100ppm max. (See Options)
Equivalent Series Resistance (ESR)	2000 Ω max. for 1.0MHz \leq F < 1.8MHz 750 Ω max. for 1.8MHz \leq F < 2.0MHz 550 Ω max. for 2.0MHz \leq F < 2.4MHz 350 Ω max. for 2.4MHz \leq F < 3.0MHz 200 Ω max. for 3.0MHz \leq F < 3.7MHz 100 Ω max. for 3.7MHz \leq F < 4.2MHz 70 Ω max. for 4.2MHz \leq F < 4.9MHz 50 Ω max. for 4.9MHz \leq F < 6.0MHz 40 Ω max. for 6.0MHz \leq F < 8.0MHz 35 Ω max. for 8.0MHz \leq F < 10.0MHz 30 Ω max. for 10.0MHz \leq F < 12.5MHz 25 Ω max. for 12.5MHz \leq F \leq 50.0MHz
Fundamental - HC49/U	1000 Ω max. for 850kHz \leq F < 900kHz 800 Ω max. for 900kHz \leq F < 1.50MHz 40 Ω max. for 24.0MHz < F \leq 66MHz 80 Ω max. for 66.0MHz < F \leq 122MHz 120 Ω max. for 122.0MHz < F \leq 160MHz
Shunt Capacitance C_0	7pF max.
Load Capacitance C_L	18pF (See Options)
Drive Level	1mW max, 100 μ W correlation
Aging @ 25°C per Year	\pm 5ppm max. (tighter aging available)
Insulation Resistance	500M Ω min. at 100Vdc \pm 15V



Dimensions: Inches (mm)

Environmental, and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Application notes, see appendix A. * Please, see outline dimensions of HC51/U and Value added, see appendix D.

ORDERING OPTIONS

AB - Frequency - CL - ESR - Temperature - Tolerance - Stability - Mode - Value Added - Packaging
XX.XXX MHz or kHz
RXXX (value in Ω)
Load cap. in pF or -S for Series
-A for -10°C to + 60°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C
-1 for \pm 10ppm -7 for \pm 15ppm -2 for \pm 20ppm -3 for \pm 25ppm -4 for \pm 30ppm
-U for \pm 10ppm -G for \pm 15ppm -X for \pm 20ppm -W for \pm 25ppm -Y for \pm 30ppm -H for \pm 35ppm -Z for \pm 50ppm
-F (Fundamental AT > 24MHz) -FB (Fundamental BT > 24MHz)** -0 (3rd OT > 66MHz)
-I (Insulator Tab) -L (3rd Lead welded) -V (Vinyl Sleeve) -L1 (3rd Lead Soldered) -L2 (Middle 3rd Lead) -L3 (Side Welded 3rd Lead) -M (SMT Formed Leads) -MJ (Metal Jacket) -QXX (Trimmed Leads)
-T (Tape & Reel) -P (Foam) -TY (Tray Packing)

** \pm 100ppm max. stability from -10°C. to 60°C only.

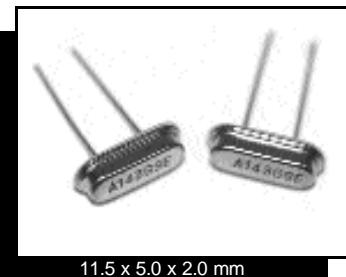
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MICROPROCESSOR CRYSTALS
AT49 (HC49 US) ULTRA LOW PROFILE
ABL, ABL2, ABL3



FEATURES:

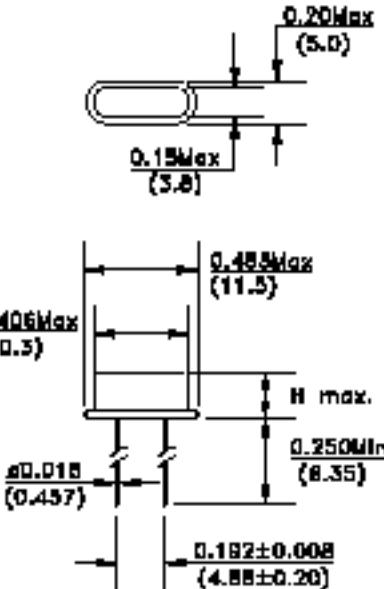
- High reliability, Low cost.
- Tight stability and extended temperature.
- Low profile.(2.0mm max. ABL3)
- Proven resistance welded metal package.

APPLICATIONS:

- Blue-tooth and wireless applications.
- Computers, Modems, Communications.
- Automotive and industrial.
- Hi-precision TCXO and clock applications.

STANDARD SPECIFICATIONS

Frequency Range	3.579545MHz - 70.00MHz
Operation Mode	$3.579545\text{MHz} \leq F \leq 24.0\text{MHz}$ (Fundamental) $24.0\text{MHz} < F \leq 50.00\text{MHz}$ (Fund. AT or BT) $24.0\text{MHz} < F \leq 70\text{MHz}$ (Third- Overtone)
Operating Temperature	0°C to $+70^\circ\text{C}$ (See Options)
Storage Temperature	-40°C to $+85^\circ\text{C}$
Frequency Tolerance @ 25°C	$\pm 50\text{ppm}$ max. (See Options)
Frequency stability over temp.	$\pm 50\text{ppm}$ max. (See Options)*
Equivalent Series Resistance (ESR)	180 Ω max. for $3.5\text{MHz} \leq F < 5.0\text{MHz}$ 120 Ω max. for $5.0\text{MHz} \leq F < 6.0\text{MHz}$ 100 Ω max. for $6.0\text{MHz} \leq F < 8.0\text{MHz}$ 80 Ω max. for $8.0\text{MHz} \leq F < 9.0\text{MHz}$ 60 Ω max. for $9.0\text{MHz} \leq F < 10.0\text{MHz}$ 50 Ω max. for $10.0\text{MHz} \leq F < 16.0\text{MHz}$ 40 Ω max. for $16.0\text{MHz} < F \leq 50.0\text{MHz}$ 100 Ω max. for $24.0\text{MHz} < F < 32.0\text{MHz}$ 80 Ω max. for $32.0\text{MHz} \leq F \leq 70.0\text{MHz}$
Fundamental	
Third Overtone	
Shunt Capacitance C_0	7pF max.
Load Capacitance C_L	18pF (See Options)
Drive Level	1mW max., 100 μW correlation
Aging @ 25°C per Year	$\pm 5\text{ppm}$ max.
Insulation Resistance	500M Ω min. at 100Vdc $\pm 15\text{V}$



Part Number	H (max.)
ABL	0.138 (3.5)
ABL2	0.099 (2.5)
ABL3	0.079 (2.0)

Dimensions: Inches (mm)

ORDERING OPTIONS

ABLX	Frequency	CL	ESR	Temperature	Tolerance	Stability	Mode	Value Added	Packaging
Blank, 2 or 3			RXXX (value in Ω)		-H5 for $\pm 5\text{ppm}^{**}$	-R5 for $\pm 5\text{ppm}^{**}$		-I Insulator tab	-T for Tape and Reel
XX.XXXX MHz				-A for -10°C to $+60^\circ\text{C}$	-1 for $\pm 10\text{ppm}$	-U for $\pm 10\text{ppm}$		-V Vinyl sleeve	-P for Foam
Load cap.in pF or S for Series				-B for -20°C to $+70^\circ\text{C}$	-7 for $\pm 15\text{ppm}$	-G for $\pm 15\text{ppm}$		-L2 Middle third leads	-TY for Tray Packing
				-C for -30°C to $+70^\circ\text{C}$	-2 for $\pm 20\text{ppm}$	-X for $\pm 20\text{ppm}$		-QXX (trimmed leads)	
				-N for -30°C to $+85^\circ\text{C}$	-3 for $\pm 25\text{ppm}$	-W for $\pm 25\text{ppm}$	-F for Fundamental AT > 24MHz		
				-D for -40°C to $+85^\circ\text{C}$	-4 for $\pm 30\text{ppm}$	-Y for $\pm 30\text{ppm}$	-FB for Fundamental BT > 24MHz		
						-H for $\pm 35\text{ppm}$			
									** Please call for availability
									* BT cut $\pm 100\text{ppm}$ max. -10°C to $+60^\circ\text{C}$

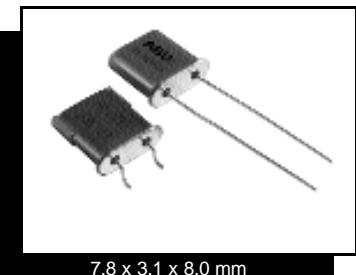
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COMMUNICATION CRYSTALS
ULTRA MINIATURE • UM-1 • UM-4 • UM-5
ABU, ABU4, ABU5

7.8 x 3.1 x 8.0 mm

FEATURES:

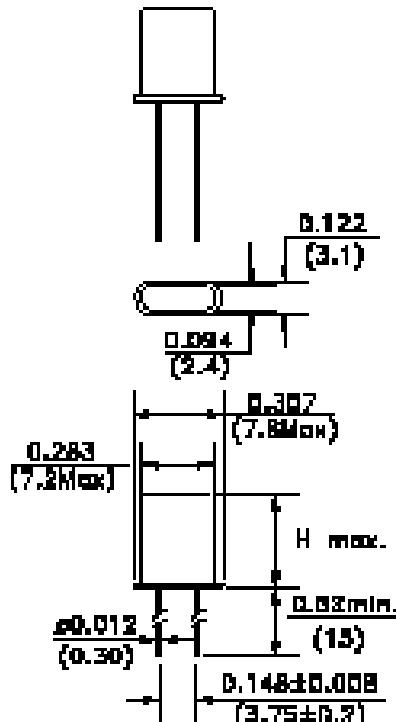
- Compact size.
- High precision crystal.
- Excellent frequency temperature characteristics across a wide temperature range.
- Hermetically sealed.

APPLICATIONS:

- Pagers, Hand-held phones, Cordless phones, Communication equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ABU (UM-1)	ABU4 (UM-4) & ABU5 (UM-5)
Frequency Range	6MHz - 200MHz	10MHz - 200MHz
Operation Mode	6.00MHz \leq F \leq 25.00MHz (Fundamental) 25.00MHz $<$ F $<$ 72.00MHz (3rd overtone) 72.00MHz $<$ F $<$ 160.00MHz (5th overtone) 160.00MHz \leq F \leq 200.00MHz (7th overtone)	
Operating Temperature	0°C to +70°C (See Options)	
Storage Temperature	-40°C to +125°C	
Frequency Tolerance @ 25°C	\pm 50ppm max. (See Options)	
Frequency Stability over Temp.	\pm 50ppm max. (See Options)	
Equivalent Series Resistance (ESR)		120 Ω max. for 6.0MHz $<$ F $<$ 7.0MHz 100 Ω max. for 7.0MHz \leq F $<$ 8.0MHz 80 Ω max. for 8.0MHz \leq F $<$ 10.0MHz 60 Ω max. for 10.0MHz \leq F $<$ 11.0MHz 50 Ω max. for 11.0MHz \leq F $<$ 12.0MHz 40 Ω max. for 12.0MHz \leq F $<$ 14.0MHz 30 Ω max. for 14.0MHz \leq F $<$ 25.0MHz
Fundamental		70 Ω max. for 25.0MHz $<$ F $<$ 72.0MHz
3rd Overtone		100 Ω max. for 72.0MHz \leq F $<$ 160.0MHz
5th Overtone		140 Ω max. for 160.0MHz \leq F $<$ 200.0MHz
Shunt Capacitance C ₀	7pF max.	
Load Capacitance C _L	18pF (See Options)	
Drive Level	1mW max., 100μW correlation	
Aging @ 25°C First Year	\pm 3ppm max. (tighter aging available)	
Insulation Resistance	500M Ω min. at 100Vdc \pm 15V	



PART NUMBER	H MAX.
UM-1 (ABU)	0.315 (8.0)
UM-4 (ABU4)	0.185 (4.7)
UM-5 (ABU5)	0.236 (6.0)

Dimensions: Inches (mm)

Environmental & mechanical specifications, see appendix C. Group 1. Marking, see appendix G.
Recommended handling, see appendix F. Reflow profile, see appendix E.

Application notes, see appendix A. Value added, see appendix D.

ORDERING OPTIONS

ABUX	- Frequency	- CL	- ESR	- Temperature	- Tolerance	- Stability	- Mode	- Value Added	- Packaging
Blank or 4,5	XXX.XXXX MHz	RXXX (value in Ω)		-A for -10°C to + 60°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C	-1 for \pm 10ppm -7 for \pm 15ppm -2 for \pm 20ppm -3 for \pm 25ppm -4 for \pm 30ppm	-R3 for \pm 3ppm -R5 for \pm 5ppm -U for \pm 10ppm -G for \pm 15ppm -X for \pm 20ppm -W for \pm 25ppm -Y for \pm 30ppm -H for \pm 35ppm -Z for \pm 50ppm	- I (Insulator Tab) - L (3rd Lead welded) - L1 (3rd Lead Soldered) - V (Vinyl Sleeving) - M (SMT Formed Leads) - MJ (Metal Jackets and Formed Leads) - QXX (Trimmed Leads)	-F (for Fundamental AT > 25 MHz)	- T (Tape & Reel) - P (Foam) - TY (Tray Packing)

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LOW FREQUENCY, 32.768kHz CYLINDRICAL TYPE

TUNING FORK CRYSTALS

AB38T and AB26T



8.3 x Ø3.2 mm or 6.2 x Ø2.1 mm

FEATURES:

- Watch frequency.
- Frequency range from 30kHz to 200kHz.
- Excellent heat resistance.

APPLICATIONS:

- Real time clock.
- Measuring instruments.
- Clock source for communication or A/V equipment.

STANDARD SPECIFICATIONS

PARAMETERS	AB38T	AB26T
Frequency Range	32.768kHz	32.768kHz 30kHz to 200kHz
Operating Temperature	-10°C to +60°C (See Options)	
Storage Temperature	-40°C to +85°C	
Turnover Temperature	25°C to ±5°C	
Frequency Tolerance @ 25°C	±20ppm max.	±20ppm max.(32.768kHz) & ±30ppm max.(others)
Frequency Stability over Temp	-0.034 ±0.006ppm / (25-T)² **	
Equivalent Series Resistance (ESR)	30kΩ max.	35kΩ max.(32.768kHz) 35kΩ ~ 50kΩ (others)
Shunt Capacitance C₀	1.6pF typical	0.8 to 1.7pF typical
Load Capacitance C₁ (See Note)	12.5pF typical (See Options)	
Motion Capacitance C₂	0.0035pF typ.	0.001 ~ 0.004pF typ.
Drive Level	1µW max.	
Quality Factor Q	90,000 typical	70,000 typical
Capacitance Ratio C₀ / C₁	460 typical	425 - 800 typical
Insulation Resistance	500 MΩ min. at 100 Vdc ±15 V	
Aging @ 25°C First year	±3ppm max.	±3ppm (32.768kHz) ±5ppm (others)

Note : Custom C_L upon request at 6 pF. Check with us for other C_L value.

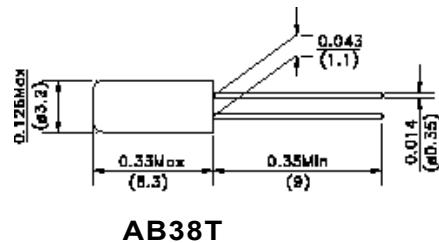
** Example: Stability at -20°C is: $-0.035 \times [25 - (-20)]^2 = -71\text{ppm}$.

Environmental, and mechanical specifications, see appendix C. Group 3.

Marking, see appendix G.

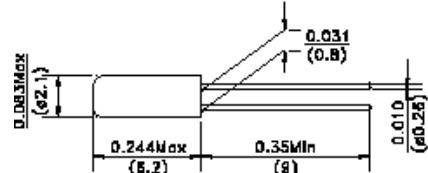
Recommended handling, see appendix F.

Application notes, see appendix A.



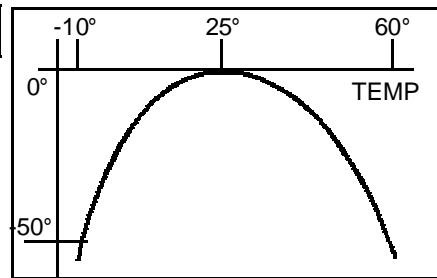
AB38T

Dimensions: Inches (mm)



AB26T

TYPICAL FREQUENCY -VS- TEMPERATURE CURVE



ORDERING OPTIONS

ABXXT - Frequency	- CL -	Temperature	- Tolerance
38 or 26	Load cap. in pF or -S for Series		-1 for ± 10ppm* -7 for ± 15ppm
XX.XXXX kHz		-E for 0°C to + 70°C -B for -20°C to + 70°C -C for -30°C to + 70°C -N for -30°C to + 85°C -D for -40°C to + 85°C	

* Please call for availability.

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10.0 x Ø3.2 mm

HIGH FREQUENCY, CYLINDRICAL TYPE MICROPROCESSOR CRYSTALS AB308 and AB310

FEATURES:

- Miniature High-Frequency crystals.
- Excellent vibration, Shock resistant.

APPLICATIONS:

- Wide range of applications.
- Communications, Measuring instruments.
- Microprocessor clocks.
- Video and audio equipment

STANDARD SPECIFICATIONS

PARAMETERS	AB308	AB310
Frequency Range	4.001MHz - 90MHz	3.5MHz - 4.000MHz
Operation Mode	4.001MHz ~ 32.0MHz (Fundamental) 30.01MHz ~ 70.0MHz (3rd overtone)	Fundamental
Operating Temperature	-10°C to +60°C (See Options)	
Storage Temperature	-40°C to +85°C	
Frequency Tolerance @ 25°C	±30ppm max. (See Options)	
Frequency Stability over Temp.	±50ppm max. (See Options)	
Equivalent Series Resistance (ESR)	150 Ω max. for 4.001MHz ≤ F < 6.0MHz 100Ω max. for 6.000MHz ≤ F < 10.0MHz 50Ω max. for 10.000MHz ≤ F ≤ 32.0MHz	200 Ω max.
Fundamental		
3rd Overtone	100Ω max. for 30.0MHz ≤ F < 36.0MHz 80 Ω max. for 36.00MHz ≤ F ≤ 90.0MHz	
Shunt Capacitance C ₀	5pF max.	
Load Capacitance C _L	16pF typical (See Options)	
Drive Level	100μW max.	
Aging @ 25°C First Year	±5ppm max.	
Insulation Resistance	500MΩ min. at 100Vdc ±15V	

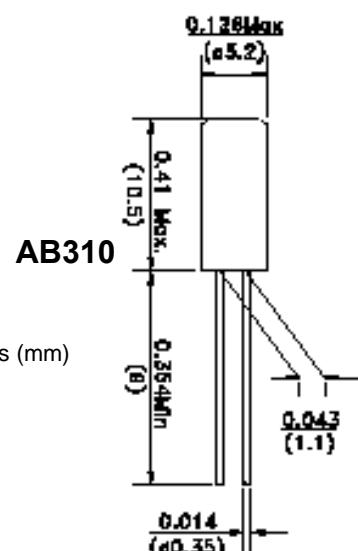
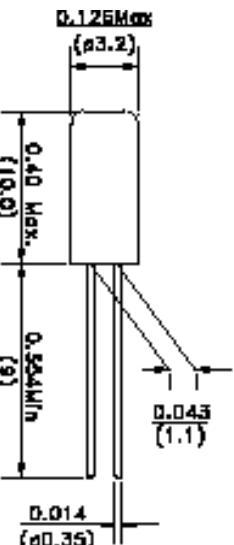
Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G.

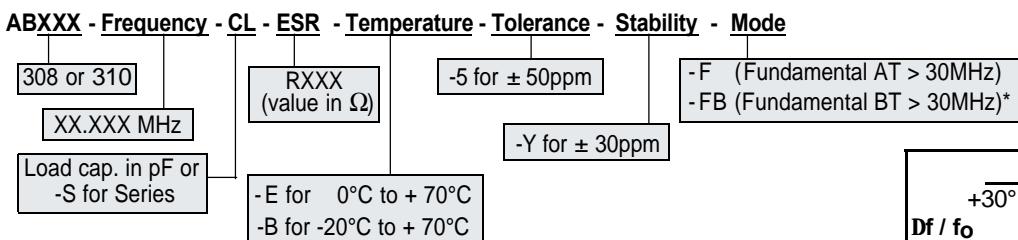
Recommended handling, see appendix F.

Application notes, see appendix A.

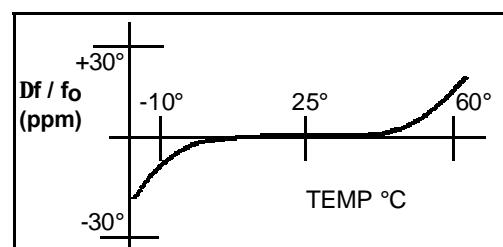
Dimensions: Inches (mm)



ORDERING OPTIONS



TYPICAL FREQUENCY
-vs-
TEMPERATURE CURVE



* +100ppm stability at -10°C to 60°C

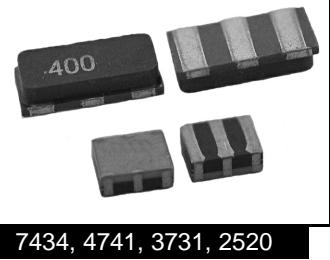
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HIGH FREQUENCY, WITH OR WITHOUT BUILT-IN CAPACITORS
SURFACE MOUNT CERAMIC RESONATORS
ASZT and ASCR



7434, 4741, 3731, 2520

FEATURES:

- Low resonant impedance.
- Built-in load capacitance (ASCR)
- Reflow capable.
- Low cost.
- Excellent environmental resistance.

APPLICATIONS:

- Remote controls.
- Electric appliances.
- Mobile phones, DVD, CD-Rom.
- Microprocessor clocks.

STANDARD SPECIFICATIONS

Abracon P/N	Freq. range (MHz)	Resonant Impedance Ω max.	Frequency tolerance	Frequency stability	Aging in 10 years	Built-in capacitance	Package Style
ASZT [] MGC	2.0~7.99	100Ω for $2.0 < F < 3.0$ MHz 50Ω for $3.0 \leq F < 3.5$ MHz 30Ω for $3.5 \leq F \leq 7.99$ MHz	±0.5%	±0.3%	±0.3%	NA	7434
ASCR [] MGC	2.0~7.99		±0.5%	±0.3%	±0.3%	30pF	7434
ASZT [] MTS	8.0~13.0		±0.5%	±0.4%	±0.3%	NA	4741
ASCR [] MTS	8.0~13.0	25Ω	±0.5%	±0.4%	±0.3%	30pF	4741
ASZT [] MTV	8.0~13.0		±0.5%	±0.4%	±0.3%	NA	3731
ASCR [] MTV	8.0~13.0	25Ω	±0.5%	±0.4%	±0.3%	15pF	3731
ASZT [] MXS	13.01~50.0		±0.5%	±0.3%	±0.3%	NA	4741
ASCR [] MXS	13.01~50.0	40Ω	±0.5%	±0.3%	±0.3%	15pF (up to 25.99MHz) 10pF (25M ~ 50M)	4741
ASZT [] MXV	13.01~50.0		±0.5%	±0.3%	±0.3%	NA	3731
ASCR [] MXV	13.01~50.0	40Ω	±0.5%	±0.3%	±0.3%	10pF	3731
ASZT [] MSS	20.0~50.0	40Ω For ≤ 32 MHZ 50Ω For ≤ 40 MHZ 60Ω For ≤ 50 MHZ	±0.5%	±0.3%	±0.3%	NA	2520
ASCR [] MSS	20.0~50.0		±0.5%	±0.3%	±0.3%	8pF	2520

Please see package options and dimensions on next page

Operating temperature: -20°C to +80°C

Storage temperature: -40°C to +85°C

We perform IC characterization to match your application.

Please call us for details.

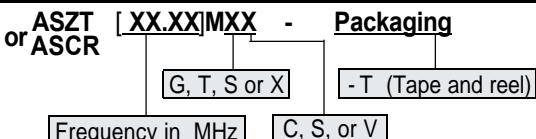
Packaging: Option Tape and Reel (1,000 pcs.) see appendix H.

Marking, see appendix G. Application notes, see appendix A.

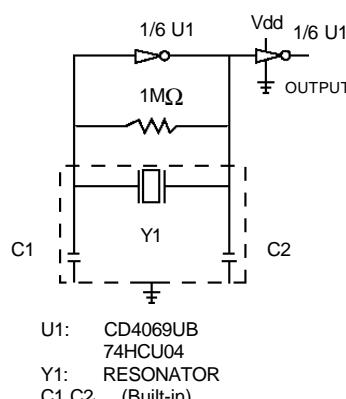
Environmental and mechanical specification, see appendix C. Group 5.

Recommended handling, see appendix F.

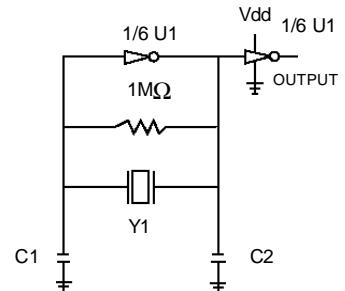
ORDERING OPTIONS



Test Circuit: ASCR



Test Circuit: ASZT



:15pF ± 20%(20M ~ 25.99M)
10pF ± 20%(25M ~ 50M)

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HIGH FREQUENCY, WITHOUT BUILT-IN CAPACITORS
SMD WASHABLE CERAMIC RESONATORS
AWSZT



7434, 4741, 3731, 2520

FEATURES:

- Low resonant impedance.
- Excellent environmental resistance.
- Reflow capable.
- High stability washable type.
- Industrial grade.

APPLICATIONS:

- Remote controls.
- Electric appliances.
- Mobile phones, DVD, CD-Rom.
- Microprocessor clocks.
- Automotive controllers.
- Industrial controllers.

STANDARD SPECIFICATIONS

Abracon P/N	Freq. range (MHz)	Resonant Impedance Ω max.	Frequency tolerance	Frequency stability @-20°C to +80°C	Aging in 10 years	Operating temperature	Package Style*
AWSZT [] MGS	2.0~7.99	100Ω for 2.0 < F < 3.0 MHz 50Ω for 3.0 ≤ F < 3.5 MHz 30Ω for 3.5 ≤ F ≤ 7.99 MHz	±0.5%	±0.3%	±0.3%	-20°C to +80°C	7434
						-40°C to +85°C	
						-40°C to +125°C	
AWSZT [] MTS	8.0~13.0	25Ω	±0.5%	±0.3%	±0.3%	-20°C to +80°C	4741
						-40°C to +85°C	
						-40°C to +125°C	
AWSZT [] MVS	8.0~13.0	25Ω	±0.5%	±0.3%	±0.3%	-20°C to +80°C	3731
						-40°C to +85°C	
						-40°C to +125°C	
AWSZT [] MXS	13.01~50.0	40Ω	±0.5%	±0.3%	±0.3%	-20°C to +80°C	4741
						-40°C to +85°C	
						-40°C to +125°C	
AWSZT [] MCS	13.01~50.0	40Ω	±0.5%	±0.3%	±0.3%	-20°C to +80°C	3731
						-40°C to +85°C	
						-40°C to +125°C	
AWSZT [] MSS	20.0~50.0	40Ω For ≤ 32MHz 50Ω For ≤ 40MHz 60Ω For ≤ 50MHz	±0.5%	±0.3%	±0.3%	-20°C to +80°C	2520
						-40°C to +85°C	
						-40°C to +125°C	

*Please see package options and dimensions on page 35A

Please check for availability on M[]D and M[]A Series

Frequency stability: M[]D: ±0.5% typ. -40°C to +85°C
M[]A: ±0.7% typ. -40°C to +125°C

Storage temperature: -40°C to +125°C

We perform IC characterization to match your application.

Please call us for details.

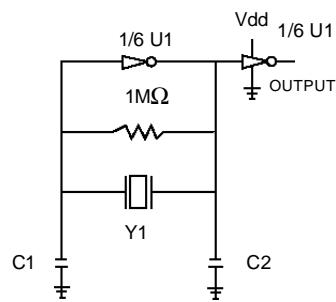
Packaging: Option Tape and Reel (1,000 pcs.) see appendix H.

Marking, see appendix G. Application notes, see appendix A.

Environmental and mechanical specification, see appendix C. Group 6.

Recommended handling, see appendix F.

Test Circuit:



U1: CD4069UB
Y1: 74HCU04 (>8MHz)
Y1: RESONATOR
C1 C2: 30pF ± 20%
:15pF ± 20%(20M ~ 25.99M)
10pF ± 20%(25M ~ 50M)

ORDERING OPTIONS

AWSZTMXX - Packaging

G,T,V,X,C or S - T (Tape and reel)
S, D or A

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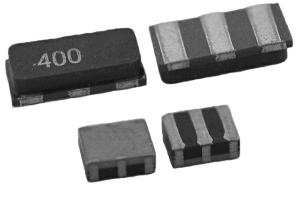
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36
Rev. B
01/2003

HIGH FREQUENCY, WITH BUILT-IN CAPACITORS
SMD WASHABLE CERAMIC RESONATORS
AWSCR



7434, 4741, 3731, 2520

FEATURES:

- Low resonant impedance.
- Excellent environmental resistance.
- Reflow capable.
- High stability washable type.
- Industrial grade.
- Built-in load capacitance.

APPLICATIONS:

- Remote controls.
- Electric appliances.
- Mobile phones, DVD, CD-Rom.
- Microprocessor clocks.
- Automotive controllers.
- Industrial controllers.

STANDARD SPECIFICATIONS

Abracon P/N	Freq. range (MHz)	Resonant Impedance Ω max.	Frequency tolerance	Frequency stability @-20°C to +80°C	Aging in 10 years	Operating temperature	Package Style *
AWSCR[]MGS	2.0~7.99	100 Ω for $2.0 < F < 3.0$ MHz 50 Ω for $3.0 \leq F < 3.5$ MHz 30 Ω for $3.5 \leq F \leq 7.99$ MHz	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	7434
AWSCR[]MTS	8.0~13.0	25 Ω	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	4741
AWSCR[]MVS	8.0~13.0	25 Ω	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	3731
AWSCR[]MXS	13.01~50.0	40 Ω	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	4741
AWSCR[]MCS	13.01~50.0	40 Ω	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	3731
AWSCR[]MSS	20.0~50.0	40 Ω For ≤ 32 MHZ 50 Ω For ≤ 40 MHZ 60 Ω For < 50 MHZ	$\pm 0.5\%$	$\pm 0.3\%$	$\pm 0.3\%$	-20°C to +80°C -40°C to +85°C -40°C to +125°C	2520

*Please see package options and dimensions on page 35A

Please check for availability on M[]D and M[]A Series

Frequency stability: M[]D: $\pm 0.5\%$ typ. -40°C to +85°C
M[]A: $\pm 0.7\%$ typ. -40°C to +125°C

Storage temperature: -40°C to +125°C

We perform IC characterization to match your application.

Please call us for details.

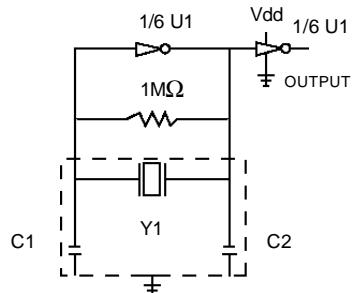
Packaging: Option Tape and Reel (1,000 pcs.) see appendix H.

Marking, see appendix G. Application notes, see appendix A.

Environmental and mechanical specification, see appendix C. Group 6.

Recommended handling, see appendix F.

Test Circuit



U1: CD4069UB

Y1: RESONATOR

C1 C2 (Built-in)

30pF $\pm 20\%$ (MG and MT Series)

15pF $\pm 20\%$ (MV Series)

15pF $\pm 20\%$ for $F < 26$ M (MX series)

10pF $\pm 20\%$ for 26 M $\leq F \leq 50$ M (MX series)

10pF $\pm 20\%$ (MC Series)

8pF $\pm 20\%$ (MS Series)

ORDERING OPTIONS

AWSCRMXX - Packaging

G,T,V,X,C or S - T (Tape and reel)

S, D or A

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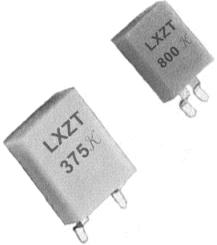
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ABRACON

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37
Rev. B
01/2003



See table 2

FORMED LEAD • LOW FREQUENCY kHz BAND SURFACE-MOUNT • CERAMIC RESONATORS **LXZTG**

FEATURES:

- Excellent environmental resistance.
- Standard frequency range from 375kHz to 1250kHz.
- Gull-wing surface-mount.
- Low cost.
- Low resonant impedance.

APPLICATIONS:

- Microprocessor clocks.
- Electrical appliances.
- Remote controls.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range	375kHz - 1250kHz *
Resonant Impedance	(See Table 1)
Operating Temperature	-20°C to +80°C (See Options)
Frequency Tolerance @ 25°C	(See Table 1)
Frequency Stability over Temp.	±0.3% max.
Load Capacitance C _L (C ₁ C ₂)	(See Table 1)
Aging in 10 Years	±0.3% max.

We can characterize your IC to meet exact oscillating conditions.

Contact Abracor for details.

* Please contact us for frequencies outside standard specification limits.

Environmental, and mechanical specifications, see appendix C. Group 5.

Marking, see appendix G. Recommended handling, see appendix F.

Application notes, see appendix A.

ORDERING OPTIONS

LXZTG - Frequency - Packaging

XXXX kHz	-	T
(Tape and Reel)		

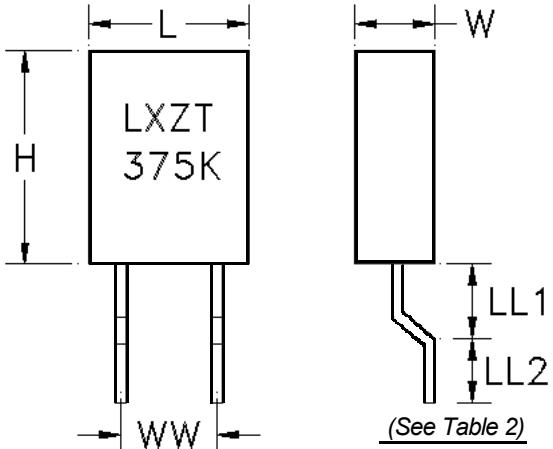
TABLE 1

Frequency Range (kHz)	Frequency Tolerance (%)	Resonant Impedance (Ω)	Load Capacitance (pF)	
			C ₁	C ₂
375 ~ 429	± 0.5%	≤ 20	120	470
430 ~ 509	± 0.5%	≤ 20	100	100
510 ~ 699	± 0.5%	≤ 30	100	100
700 ~ 900	± 0.5%	≤ 50	100	100
901 ~ 1000	± 0.5%	≤ 70	100	100
1001 ~ 1250	± 0.5%	≤ 100	100	100

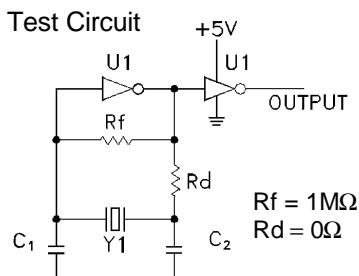
TABLE 2

Frequency Range (kHz)	Length (L)	Width (W)	Height (H)	Lead Length(LL1)	Lead Length(LL2)	Lead Spacing(ww)
375 ~ 400	0.31 (7.9)	0.14 (3.6)	0.37 (9.3)	0.047(1.2)	0.043 (1.1)	0.2 (5.0)
401 ~ 699	0.28 (7.0)	0.14 (3.5)	0.35 (9.0)	0.047(1.2)	0.043 (1.1)	0.2 (5.0)
700 ~ 1250	0.20 (5.2)	0.11 (2.8)	0.27 (6.8)	0.047(1.2)	0.043 (1.1)	0.1 (2.5)

Dimensions: Inches (mm)



Test Circuit



NOTE: Left blank if standard • All specifications and markings subject to change without notice

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10.7 MHZ, LEADED LOW LOSS CERAMIC FILTERS AFC10.7M Series



FEATURES:

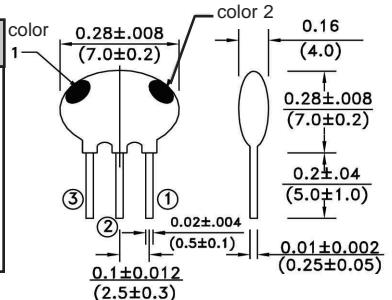
- Small size, Light weight
- Low loss and high attenuation.

APPLICATIONS:

- FM receivers
- Digital transmission systems
- Communications applications.

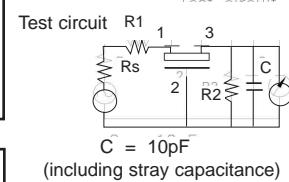
STANDARD SPECIFICATIONS AFC10.7M SERIES

Part Number	3 dB Bandwidth (kHz)	20 dB Bandwidth (kHz) max.	Insertion Loss (dB) max.	Spurious Attenuation 9-12 MHz (dB) min.	Input / Output Impedance(W)
AFC10.7MA	280 ± 50	650	6	30	330
AFC10.7MS	230 ± 50	600	6	40	330
AFC10.7MC	180 ± 40	520	7	40	330
AFC10.7MJ(*)	150 ± 40	400	10	38	330 (*)



Low-loss type

Part Number	3 dB Bandwidth (kHz)	20 dB Bandwidth (kHz) max.	Insertion Loss (dB) max.	Spurious Attenuation 9-12 MHz (dB) min.	Input / Output Impedance(W)
AFC10.7MA25	280 ± 50	590	2.5 ± 2.0	30	330
AFC10.7MS30	230 ± 50	520	3.0 ± 2.0	35	330
AFC10.7MC35	180 ± 40	470	3.5 ± 1.5	35	330
AFC10.7MJ45	150 ± 40	360	4.5 ± 2.0	35	330 (*)



Wide or narrow bandwidth type

Part Number	3 dB Bandwidth (kHz)	20 dB Bandwidth (kHz) max.	Insertion Loss (dB) max.	Spurious Attenuation 9-12 MHz (dB) min.	Input / Output Impedance(W)
AFC10.7MW350	350 min.	950	3.0 ± 2.0	20	470 (*)
AFC10.7MW330	330 ± 50	680	4.0 ± 2.0	30	330
AFC10.7MW110	110 ± 30	350	7.0 ± 2.0	30	330
AFC10.7MW20	20 min.	95	6.0 max.	24	600 (*)

Dimensions: Inches (mm)

Color Code

Category	Center Frequency	Color
A	10.70MHz±30kHz	Red
B	10.67MHz±30kHz	Blue
C	10.76MHz±30kHz	White
D	10.64MHz±30kHz	Black
E	10.73MHz±30kHz	Orange

ORDERING OPTIONS

AFC10.7MXXXX - Packaging

see part number

- Ammo (Ammo pack)

Storage temperature: -40°C to +85°C

Packaging: Bulk: Plastic packing 500pcs. See appendix H.

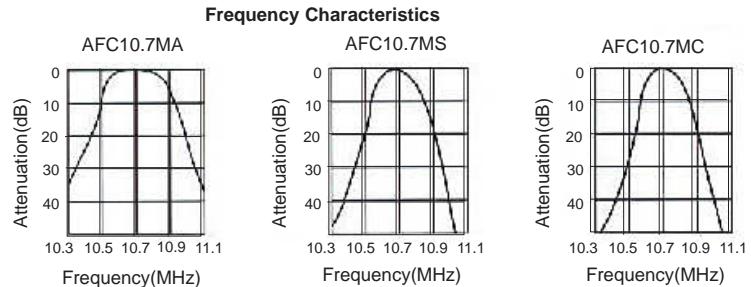
Ammo pack (Taping): carton box packing: 1,500pcs. See appendix H

Environmental and mechanical specification, see appendix C. Group 6.

Marking, see appendix G. Application notes, see appendix A.

Recommended handling, see appendix F.

(*) As of 09/02 parts are under development.



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10.7 MHZ, SURFACE MOUNT LOW LOSS CERAMIC FILTERS ASFC10.7M Series



7 x 3 x 1.5 mm

FEATURES:

- Small size, Light weight
- Low loss and high attenuation.

APPLICATIONS:

- FM receivers
- Digital transmission systems
- Communications applications.

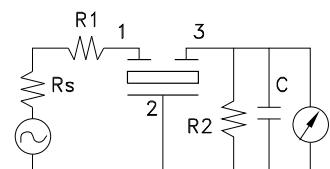
STANDARD SPECIFICATIONS AFC10.7M SERIES

Part Number	3 dB Bandwidth (kHz)	20 dB Bandwidth (kHz) max.	Insertion Loss (dB) max.	Spurious Attenuation 9-12 MHz (dB) min.	Input / Output Impedance(W)
ASFC10.7MA	280 ± 50	650	6	30	330
ASFC10.7MS	230 ± 50	600	6	30	330 (*)

Low-loss type

Part Number	3 dB Bandwidth (kHz)	20 dB Bandwidth (kHz) max.	Insertion Loss (dB) max.	Spurious Attenuation 9-12 MHz (dB) min.	Input / Output Impedance(W)
ASFC10.7MA30	280 ± 50	590	3.0 ± 2.0	35	330 (*)
ASFC10.7MS35	230 ± 50	510	3.5 ± 2.0	35	330 (*)
ASFC10.7MC40	180 ± 40	470	4.0 ± 2.0	35	330 (*)

Test circuit



C = 10pF
(including stray capacitance)
Rs+R1 = R2 = 330 ohms

ORDERING OPTIONS

Dimensions: Inches (mm)

ASFC10.7MXXX - Packaging

see part number

T for Tape and Reel

Storage temperature: -40°C to +85°C

Packaging: Option Tape and Reel (4,000pcs.) See appendix H.

Environmental and mechanical specification, see appendix C. Group 6.

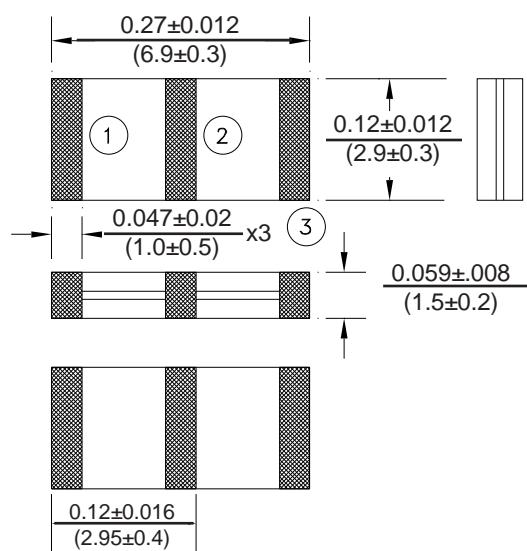
Marking, see appendix G. Application notes, see appendix A.

Recommended handling, see appendix F.

(*) As of 09/02 parts are under development.

Pin connections

1	Input
2	GND
3	Output



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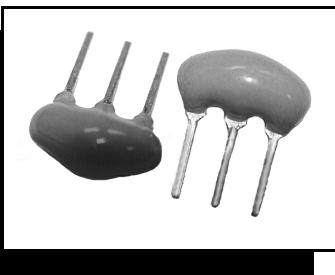
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HIGH FREQUENCY LEADED • BUILT-IN CAPACITORS

CERAMIC RESONATORS

ACR



FEATURES:

- Excellent environmental resistance
- Built-in capacitors save space & components.
- Low cost timing solution.

APPLICATIONS:

- Microprocessor clocks.
- Electric appliances.
- Remote controls.

STANDARD SPECIFICATIONS

Frequency Range (MHz)	Frequency Tolerance (at 25°C)	Frequency Stability (at -20°C to 80°C)	Resonant Impedance (Ω) max.	Operating temperature	Aging (10 yrs)	IC Tested	Vdd
1.8 ~ 6.00	±0.5%	±0.3%	100 for $1.80 \leq F < 3.0$ 50 for $3.0 \leq F < 3.5$ 30 for $3.5 \leq F \leq 6.0$	-20°C to +80°C	±0.3%	MC14069UBP	5V
6.01 ~ 13.00	±0.5%	±0.3%	30	-20°C to +80°C	±0.3%	MC14069UBP	12V
13.01 ~ 50.00	±0.5%	±0.3%	40	-20°C to +80°C	±0.3%	TC74HCU04	5V

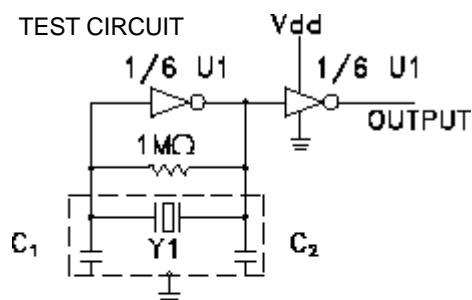
We can characterize your IC to meet exact oscillating conditions.
Contact Abracor for details.

Environmental and mechanical specifications, see appendix C. Group 5.
Marking, see appendix G. Recommended handling, see appendix F.
Application notes, see appendix A.
Ammo packing, see appendix H.(1,500 pcs/box)

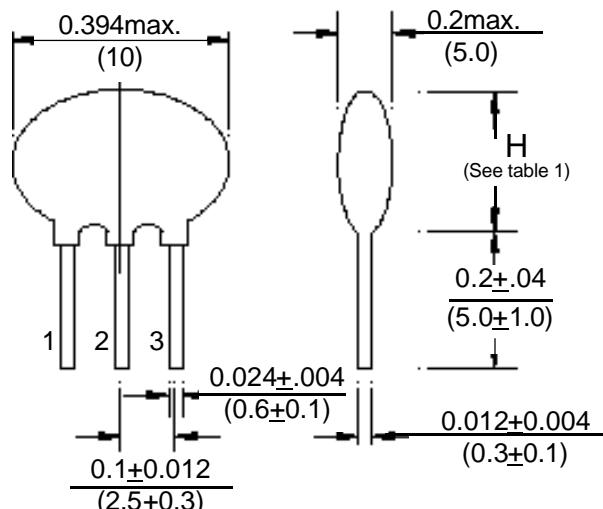
ORDERING OPTIONS

ACR - Frequency - Packaging

XX.XXX MHz - Ammo (ammo packing)



1	Input
2	Ground
3	Output



U1: MC14069UBP

74HCU04

Y1: RESONATOR

Built-in C1 C2: 30pF ± 20% (1.8M ~ 20.0MHz)
15pF ± 20% (20.01M ~ 25.99MHz)
5pF ± 20% (26.0M ~ 50MHz)

Table 1

Freq. (MHz)	H (max.)
1.8 ~ 6.0	0.315 (8.0)
6.01 ~ 50.0	0.395(10.0)

Dimensions: Inches (mm)

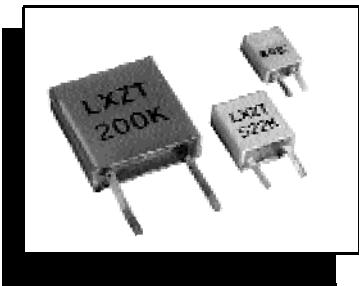
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**LEADED • LOW FREQUENCY kHz BAND
CERAMIC RESONATORS
LXZT**

FEATURES:

- Excellent environmental resistance.
- Standard frequency range from 190kHz to 1250kHz.
- Ammo packaging options.
- Low cost timing solution.
- Low resonant impedance.

APPLICATIONS:

- Microprocessor clocks.
- Electrical appliances.
- Remote controls.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range	190kHz - 1250kHz *
Resonant Impedance	(See Table 1)
Operating Temperature	-20°C to +80°C (See Options)
Frequency Tolerance @ 25°C	(See Table 1)
Frequency Stability over Temp.	±0.3% max.
Load Capacitance C _L (C ₁ C ₂)	(See Table 1)
Aging in 10 Years	±0.3% max.

We can characterize your IC to meet exact oscillating conditions. Contact Abracan for details.

* Please contact us for higher or lower frequencies..

Environmental, and mechanical specifications, see appendix C. Group 5.

Marking, see appendix G. Ammo packing, see appendix H.(3,000 pcs/box)

Recommended handling, see appendix F.

Application notes, see appendix A.

ORDERING OPTIONS

LXZT - Frequency - Packaging

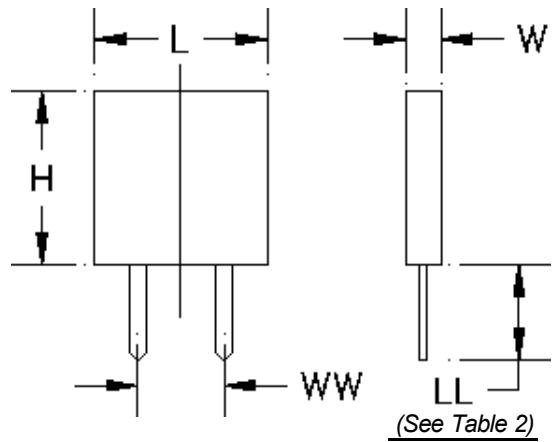
XXXX kHz - Ammo
 (ammo packing)

TABLE 1

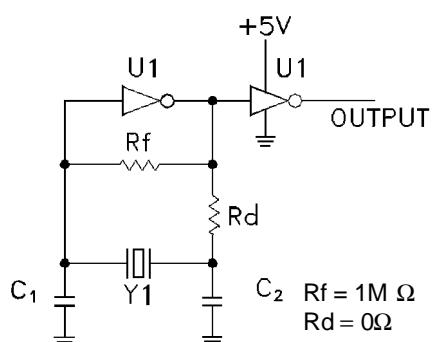
Frequency Range (kHz)	Frequency Tolerance	Resonant Impedance (Ω)	Load Capacitance (pF)	
			C ₁	C ₂
190 ~ 249	± 1kHz	≤ 20	330	470
250 ~ 375	± 1kHz	≤ 20	220	470
376 ~ 429	± 2kHz	≤ 20	120	470
430 ~ 509	± 2kHz	≤ 20	100	100
510 ~ 699	± 2kHz	≤ 30	100	100
700 ~ 999	± 0.5%	≤ 70	100	100
1000 ~ 1250	± 0.5%	≤ 100	100	100

TABLE 2

Frequency Range (kHz)	Length (L)	Width (w)	Height (H)	Lead Length(LL)	Lead Spacing(ww)
190 ~ 249	0.53 (13.5)	0.15 (3.8)	0.58 (14.7)	0.31 (8.0)	0.39 (10.0)
250 ~ 375	0.43 (11.0)	0.15 (3.8)	0.48 (12.6)	0.28 (7.0)	0.3 (7.7)
376 ~ 400	0.31 (7.1)	0.14 (3.6)	0.35 (9.3)	0.3 (7.7)	0.2 (5.0)
401 ~ 699	0.28 (7.0)	0.14 (3.5)	0.35 (9.0)	0.24 (6.0)	0.2 (5.0)
700 ~ 1250	0.28 (5.2)	0.11 (2.8)	0.26 (6.8)	0.2 (5.0)	0.1 (2.5)



Test Circuit





HIGH FREQUENCY, LEADED CERAMIC RESONATORS HXZT Series

FEATURES:

- Low resonant impedance.
- Low cost timing solution.
- Small size, Light weight.
- Excellent environmental resistance.

APPLICATIONS:

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

STANDARD SPECIFICATIONS

Frequency Range (MHz)	Frequency Tolerance (at 25°C)	Frequency Stability (at -20°C to 80°C)	Resonant Impedance	Operating temperature	Aging (10 yrs)	IC Tested	Vdd
1.8 ~ 6.00	±0.5%	±0.3%	100 for $1.80 \leq F < 3.0$ 50 for $3.0 \leq F < 3.5$ 30 for $3.5 \leq F < 6.0$	-20°C to +80°C	±0.3%	MC14069UBP	5V
6.01 ~ 13.00	±0.5%	±0.3%	30	-20°C to +80°C	±0.3%	MC14069UBP	12V
13.01 ~ 50.00	±0.5%	±0.3%	40	-20°C to +80°C	±0.3%	TC74HCU04	5V

We can characterize your IC to meet exact oscillating conditions.

Contact Abracan for details.

Storage temperature: -40°C to +85°C

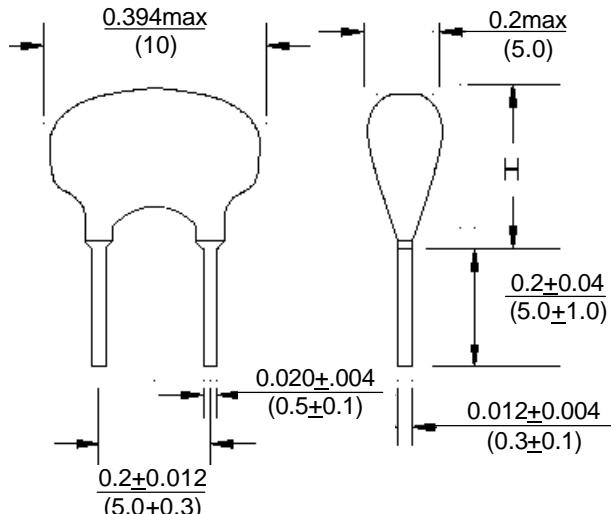
Packaging: Bulk: Plastic packing 500pcs. See appendix H.

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

Environmental and mechanical specification, see appendix C. Group 5.

Marking, see appendix G. Application notes, see appendix A.

Recommended handling, see appendix F.



ORDERING OPTIONS

HXZT - Frequency - Packaging

XX.XXX MHz - Ammo (ammo packing)

Test Circuit

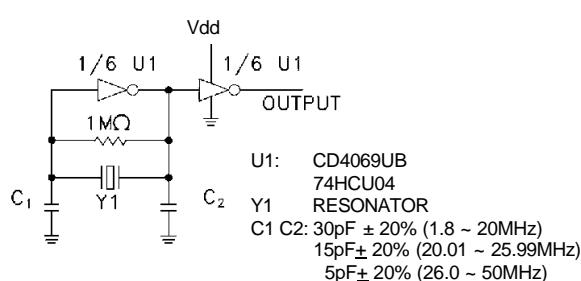


Table 1

Freq. (MHz)	H (max.)
1.8 ~ 13.0	0.295 (7.5)
13.01 ~ 23.99	0.395 (10)
24.0 ~ 50.0	0.295 (7.5)

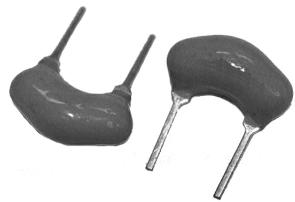
Dimensions: Inches (mm)

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See table 1

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

FEATURES:

- Low resonant impedance.
- High stability washable type.
- Small size, Light weight.
- Excellent environmental resistance.
- Low cost timing solution.

APPLICATIONS:

- Remote control systems in vehicles.
- Industrial controllers.
- Electric appliances.
- Clock oscillation for microcontrollers.
- Household electric appliances.
- Automotive controllers.

STANDARD SPECIFICATIONS

Frequency Range (MHz)	Frequency Tolerance (at 25°C)	Frequency Stability (at -20°C to 80°C)	Resonant Impedance (Ω) max.	Operating temperature	Aging (10 yrs)	IC Tested	Vdd
1.8 ~ 6.00	±0.5%	±0.3%	100 for $1.80 \leq F < 3.0$ 50 for $3.0 \leq F < 3.5$ 30 for $3.5 \leq F \leq 6.0$	See table 2	±0.3%	MC14069UBP	5V
6.01 ~ 13.00	±0.5%	±0.3%	30	See table 2	±0.3%	MC14069UBP	12V
13.01 ~ 50.00	±0.5%	±0.3%	40	See table 2	±0.3%	TC74HCU04	5V

We can characterize your IC to meet exact oscillating conditions.
Contact Abracan for details.

Storage temperature: -40°C to +125°C

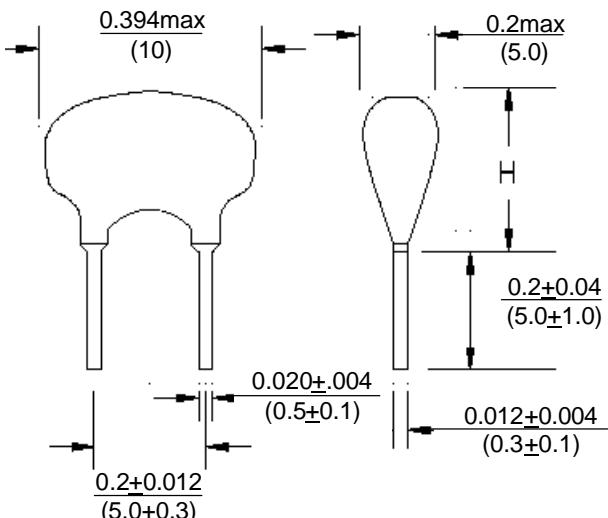
Packaging: Bulk: Plastic packing 500pcs. See appendix H.

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

Environmental and mechanical specification, see appendix C. Group 6.

Marking, see appendix G. Application notes, see appendix A.

Recommended handling, see appendix F.



ORDERING OPTIONS

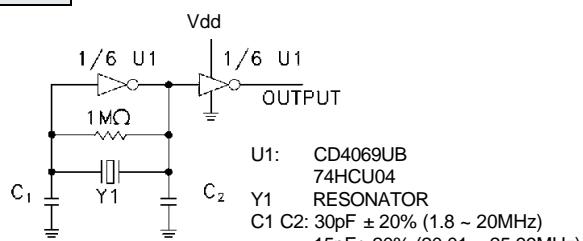
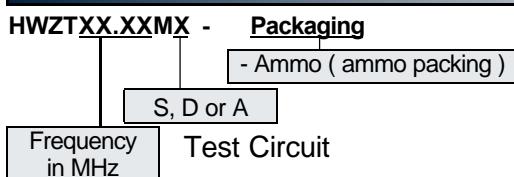


Table 1

Freq. (MHz)	H (max.)
1.8 ~ 13.0	0.295 (7.5)
13.01 ~ 23.99	0.395 (10)
24.0 ~ 50.0	0.295 (7.5)

Table 2

Series	Operating temperature
MS	-20°C to +80°C
MD	-40°C to +85°C
MA	-40°C to +125°C

(Freq.stability ~ ± 0.5% typ.)
(Freq.stability ~ ± 0.7% typ.)

Dimensions: Inches (mm)

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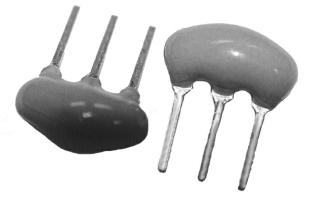
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HIGH FREQUENCY LEADED • BUILT-IN CAPACITORS, INDUSTRIAL GRADE

CERAMIC RESONATORS

AWCR Series



FEATURES:

- Excellent environmental resistance, Low cost.
- Built-in capacitors save space & components.
- High-stability, Washable type
- Small size , Light weight
- Low cost timing solution.

APPLICATIONS:

- Microprocessor clocks.
- Electric appliances.
- Remote controls.
- Automotive controllers.
- Industrial controllers.
- General timing.

STANDARD SPECIFICATIONS

Frequency Range (MHz)	Frequency Tolerance (at 25°C)	Frequency Stability (at -20°C to 80°C)	Resonant Impedance (Ω) max.	Operating temperature	Aging (10 yrs)	IC Tested	Vdd
1.8 ~ 6.00	±0.5%	±0.3%	100 for $1.80 \leq F < 3.0$ 50 for $3.0 \leq F < 3.5$ 30 for $3.5 \leq F \leq 6.0$	See table 2	±0.3%	MC14069UBP	5V
6.01 ~ 13.00	±0.5%	±0.3%	30	See table 2	±0.3%	MC14069UBP	12V
13.01 ~ 50.00	±0.5%	±0.3%	40	See table 2	±0.3%	TC74HCU04	5V

Storage temperature: -40°C to +125°C

Environmental and mechanical specifications, see appendix C. Group 6.

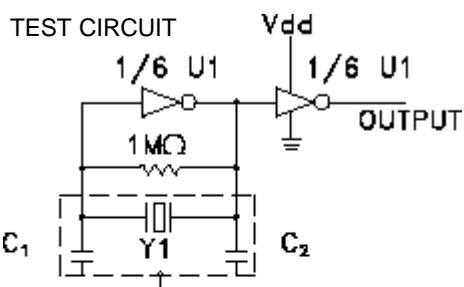
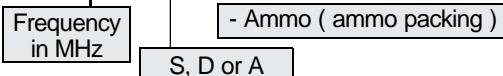
Marking, see appendix G. Recommended handling, see appendix F.

Application notes, see appendix A.

Ammo packing, see appendix H.(1,500 pcs/box)

ORDERING OPTIONS

AWCRXX.XXMX - Packaging



Built-in C1 C2: $30\text{pF} \pm 20\%$ (1.8M ~ 20.0MHz)
 $15\text{pF} \pm 20\%$ (20.01M ~ 25.99MHz)
 $5\text{pF} \pm 20\%$ (26.0M ~ 50MHz)

Dimensions: Inches (mm)

1	Input
2	Ground
3	Output

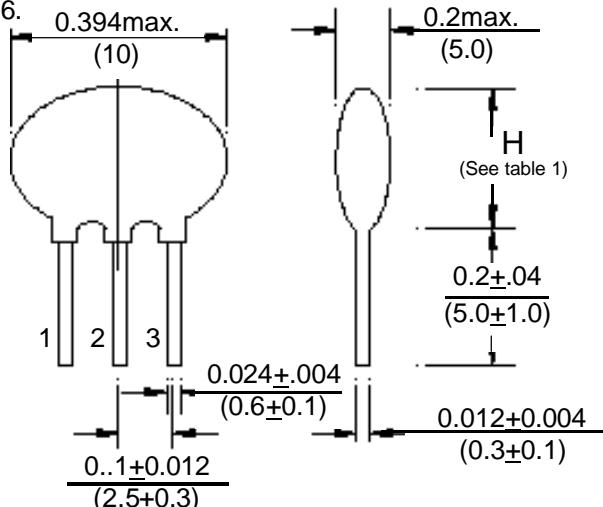


Table 1

Freq. (MHz)	H (max.)
1.8 ~ 6.0	0.315 (8.0)
6.01 ~ 50.0	0.395(10.0)

Table 2

Series	Operating temperature
MS	-20°C to +80°C
MD	-40°C to +85°C
MA	-40°C to +125°C

(Freq.stability ~ $\pm 0.5\%$ typ.)
(Freq.stability ~ $\pm 0.7\%$ typ.)

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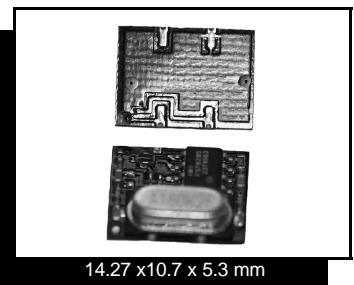
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5.0VDC or 3.3VDC • HCMOS/ TTL SPREAD-SPECTRUM • SURFACE-MOUNT

ULTRA LOW NOISE CRYSTAL CLOCK OSCILLATORS

ASSM and ASSML



14.27 x10.7 x 5.3 mm

FEATURES:

- Patented spread spectrum technology.
- Standard TTL or HCMOS compatible output.
- Meets clock requirements on all major CISC, RISC, and DSP processors.
- Reduce electromagnetic emissions up to 20dB!
- Meets FCC and EMC Directive for EMI requirements.
- Drop-in replacement for standard plastic SMD crystal oscillators
- Wide frequency range 4.0MHz to 128MHz.

APPLICATIONS:

- Telecommunications.
- Capital equipment.
- Aerospace.
- Consumer electronics, printers.
- Medical equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ASSM	ASSML
Frequency Range (F _o)	4.0MHz - 128MHz	
Operating Temperature (T _{OPR})	0°C to +70°C(See Options)	
Storage Temperature (T _{STO})	-65°C to +150°C	
Frequency Stability VS.Temp.(ΔF/F _o)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5.0Vdc ± 5%	3.3Vdc ± 5%
Input Current (I _{dd})	30mA max.	
Duty Cycle (S _{ym})	45/55% max.	
Rise and Fall Times (T _r / T _f)	3.5ns max.	
Output Load	10LSTTL or 15pF	
Output Voltage (V _{OH} , V _{OL})	V _{dd} - 1.0V min. (V _{OH}) ; 0.4Vdc max. (V _{OL})	
Start-up Time (T _{osc})	10ms max., 5ms typ.	
Aging	±5ppm max./year	
Jitter	250ps typ.	
Bandwidth variations	5% typ. (±2.5% of center frequency)(See Options)	

Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.

Environmental and mechanical specifications, Please call Abraccon for details.

Recommended handling, see appendix F.

ORDERING OPTIONS

ASSMX - Frequency - Temperature - Frequency Stability - Bandwidth - Packaging

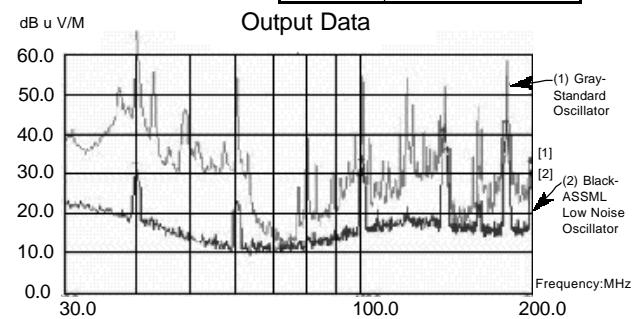
Blank or L XX.XXXX MHz

-E for -20°C to +70°C
-F for -30°C to +70°C
-N for -30°C to +85°C
-L for -40°C to +85°C

-R for ± 25ppm max
-K for ± 30ppm max
-H for ± 35ppm max
-C for ± 50ppm max

-T for Tape and Reel

B1 for 1%(±0.5% of F_o)
B2 for 2%(±1% of F_o)
B3 for 3%(±1.5% of F_o)
B4 for 4%(±2% of F_o)



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Rev A
2/2003

5.0VDC or 3.3VDC • 8 PIN DIP • HCMOS/ TTL SPREAD-SPECTRUM
ULTRA LOW NOISE CRYSTAL CLOCK OSCILLATORS
ACSH and ACSHL



FEATURES:

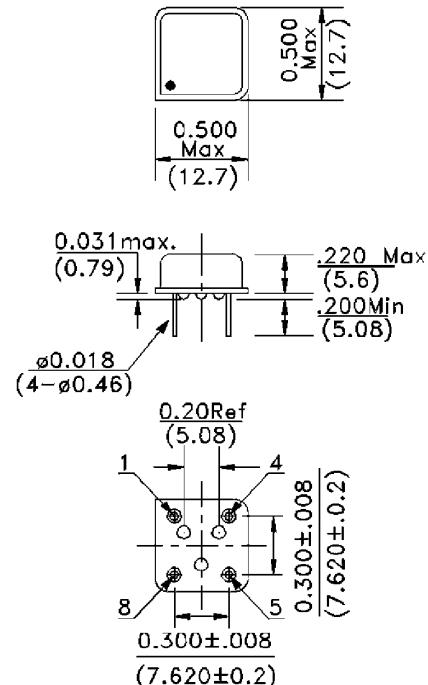
- Patented spread spectrum technology.
- Standard TTL or HCMOS compatible output.
- Meets clock requirements on all major CISC, RISC, and DSP processors.
- Reduce electromagnetic emissions up to 20dB!
- Meets FCC and EMC Directive for EMI requirements.
- Plug-in replacement for standard 8 pin DIP crystal oscillators.
- Wide frequency range 8MHz to 128MHz.

APPLICATIONS:

- Telecommunications.
- Capital equipment.
- Aerospace.
- Consumer electronics, printers.
- Medical equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ACSH	ACSHL
Frequency Range (F ₀)	8.000MHz - 128MHz	
Operating Temperature (T _{OPR})	0°C to +70°C(See Options)	
Storage Temperature (T _{STO})	-65°C to +150°C	
Frequency Stability VS.Temp.(ΔF/F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5.0Vdc ± 5%	3.3Vdc ± 5%
Input Current (I _{dd})	30mA max.	
Duty Cycle (S _{YM})	45/55% max.	
Rise and Fall Times (Tr / Tf)	3.5ns max.	
Output Load	10LSTTL or 15pF	
Output Voltage (V _{OH} , V _{OL})	Vdd - 1.0V min. (V _{OH}) ; 0.4Vdc max. (V _{OL})	
Start-up Time (T _{osc})	10ms max. ,5ms typ.	
Aging	±5ppm max./year	
Jitter	250ps typ.	
Bandwidth variations	5% typ. (±2.5% of center frequency)(See Options)	



Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Application notes, see appendix A.. Value added, see appendix D.

Recommended handling, see appendix F.

Dimensions: Inches (mm)

PIN NUMBER	FUNCTION
1	NC
4	GND
5	Output
8	V _{dd}

ORDERING OPTIONS

ACSHX - Frequency - Temperature - Frequency Stability - Bandwidth - Value Added - Packaging

Blank or L XX.XXXX MHz

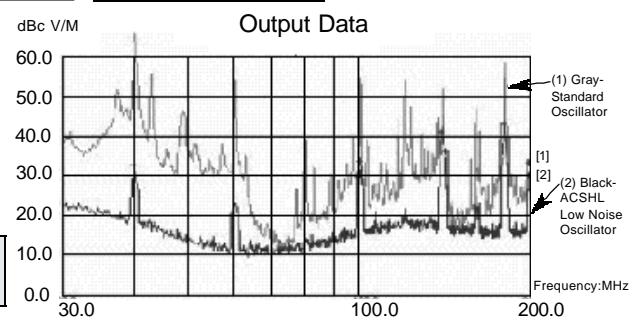
-E for -20°C to +70°C
-E for -30°C to +70°C
-N for -30°C to +85°C
-L for -40°C to +85°C

-R for ± 25ppm max
-K for ± 30ppm max
-H for ± 35ppm max
-C for ± 50ppm max

-TY for Tray packing

B1 for 1%(±0.5% of F₀)
B2 for 2%(±1% of F₀)
B3 for 3%(±1.5% of F₀)
B4 for 4%(±2% of F₀)

-G Gull Wing
-QXX (Trimmed Leads)



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® Rev A
2/2003

5.0VDC or 3.3VDC • 14 PIN DIP • HCMOS/ TTL SPREAD-SPECTRUM

ULTRA LOW NOISE CRYSTAL CLOCK OSCILLATORS ACSO and ACSOL



FEATURES:

- Patented spread spectrum technology.
- Standard TTL or HCMOS compatible output.
- Meets clock requirements on all major CISC, RISC, and DSP processors.
- Reduce electromagnetic emissions up to 20dB!
- Meets FCC and EMC Directive for EMI requirements.
- Drop-in replacement for standard 14 pin DIP crystal oscillators.
- Wide frequency range 4MHz to 128MHz.

APPLICATIONS:

- Telecommunications.
- Consumer electronics, printers.
- Capital equipment.
- Medical equipment.
- Aerospace.

STANDARD SPECIFICATIONS

PARAMETERS	ACSO	ACSO
Frequency Range (F ₀)	4.000MHz - 128MHz	
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-65°C to +150°C	
Frequency Stability VS.Temp.(ΔF/F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5.0Vdc ± 5%	3.3Vdc ± 5%
Input Current (I _{dd})	30mA max.	
Duty Cycle (S _{YM})	45 / 55% max.	
Rise and Fall Times (T _r / T _f)	3.5ns max.	
Output Load	10LSTTL or 15pF	
Output Voltage (V _{OH} , V _{OL})	V _{dd} - 1.0V min. (V _{OH}) ; 0.4Vdc max. (V _{OL})	
Start-up Time (T _{osc})	10ms max. ,5ms typ.	
Aging	±5ppm max./year	
Jitter	250ps typ.	
Bandwidth variations	5% typ. (±2.5% of center frequency) (See Options)	

Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Application notes, see appendix A.. Value added, see appendix D.

Recommended handling, see appendix F.

ORDERING OPTIONS

ACSOX - Frequency - Temperature - Frequency Stability - Bandwidth - Value Added - Packaging

Blank or L XX.XXXX MHz

-R for ± 25ppm max

-TY for Tray packing

-E for -20°C to + 70°C

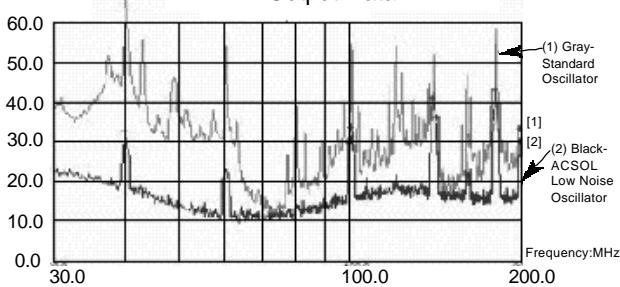
-K for ± 30ppm max

dBc V/M

Output Data

-F for -30°C to + 70°C

-H for ± 35ppm max



-N for -30°C to + 85°C

-C for ± 50ppm max

-L for -40°C to + 85°C

B1 for 1%(±0.5%of F₀)
B2 for 2%(±1%of F₀)
B3 for 3%(±1.5%of F₀)
B4 for 4%(±2%of F₀)

-G Gull Wing
-QXX (Trimmed Leads)

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5.0 x 3.2 x 1.6 mm

5.0 Vdc or 3.3 Vdc • LOW PROFILE ULTRA MINIATURE CERAMIC SURFACE MOUNT CRYSTAL CLOCK OSCILLATORS ASF1, ASFL and ASFL1

FEATURES:

- Compact and low in height.(1.6 mm or 1.2 mm max.)
- Low current consumption.
- Tri state function.

- Suitable for high density SMT., Reflow capable.
- Tight stability option.
- Glass sealed package.

APPLICATIONS:

- CCD clock for VTR camera.
- Equipment connected to PC or PC cards.
- Thin equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ASF1	ASFL	ASFL1
Frequency Range (F ₀)	1.50MHz ~ 125MHz		
Operating Temperature (T _{OPR})	-10°C to +70°C		
Storage Temperature (T _{STO})	-50°C to +125°C		
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)		
Supply Voltage (V _{dd})	5.0 Vdc ±10%	3.3Vdc ±10%	
Input Current (I _{dd})	20mA max. 45mA max. 50mA max. 100mA max.	12mA max. for (F < 33MHz) 25mA max. for (F < 50MHz) 35mA max. for (F < 70MHz) 60mA max. for (F ≤ 125MHz)	
Duty Cycle or Symmetry	40 / 60% max. (See Options)		
Rise and Fall Times (T _R / T _F)	6ns max.		
Output Load	5TTL or 15pF(50pF max.) 2TTL or 15pF	5TTL or 15pF(30pF max.) for F < 70MHz 2TTL or 15pF for F ≥ 70MHz	
Output Voltage (V _{OH}) (V _{OL})	"1" 0.9 * V _{dd} min. "0" 0.1* V _{dd} max.		
Tri-State Function	"1" or Open: Oscillation "0": Output disabled (Hi Z)	≥ 2.2V < 0.8V	
Start-up Time	10ms max.		
Aging per Year	±5ppm @ 25°C		

Connect a By-Pass capacitor 0.01 μF between V_{dd} and GND.

Environmental, and mechanical specifications, see appendix C. Group 2.

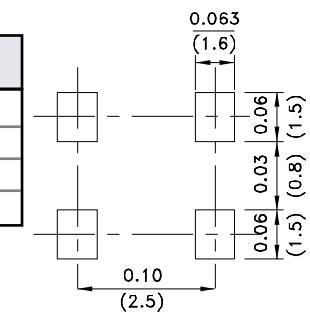
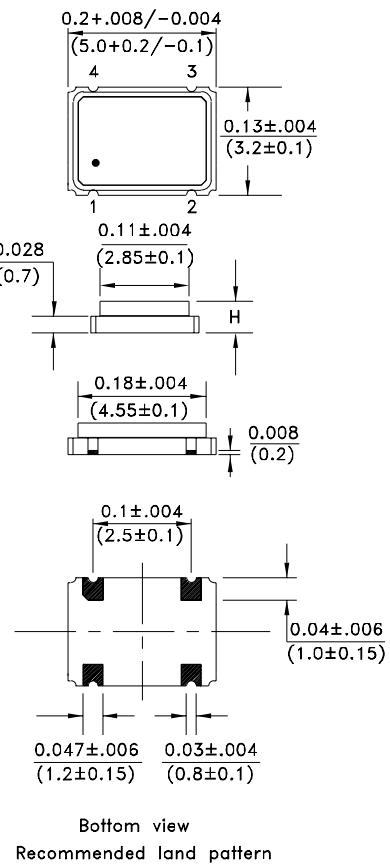
Marking, see appendix G. Test circuit, waveforms, see appendix B.

Tape and Reel, see appendix H.(1,000 pcs/reel).

Reflow profile, see appendix E.

Application notes, see appendix A.

PIN NO.	FUNCTION
1	Tri State
2	GND / Case
3	Output
4	V _{dd}



P/N	H
ASFL	0.063+0.006 (1.6+0.15)
ASF1, ASFL1	0.043+0.004 (1.1+0.1)

Dimensions: Inches (mm)

* Vary with frequency and temperature.

ASFXX - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Packaging

Blank or L
Blank or 1
XX.XXXXX MHz

- E for -20°C to + 70°C
- F for -30°C to + 70°C
- N for -30°C to + 85°C
- L for -40°C to + 85°C
- J for ± 20ppm max.*
- R for ± 25ppm max.*
- K for ± 30ppm max.*
- H for ± 35ppm max.*
- B for ± 40ppm max.
- C for ± 50ppm max.

-T
(Tape & Reel)
-S for 45/55% @ 1/2 V_{dd}

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5Vdc or 3.3Vdc • MINIATURE CERAMIC SURFACE MOUNT • HCMOS OR TTL

PROGRAMMABLE CLOCK OSCILLATORS

ASFP and ASFLP



5.0 x 3.2 x 1.6 mm

FEATURES:

- Wide range of frequency up to 133MHz using PLL technology.
- Quick delivery within one to five days for small quantities.
- Ultra miniature low profile SMD 5.0x3.2x1.6mm package.
- Reflow soldering.
- Tristate E/D or Stand-By function.
- Hermetically seam welded.

1 to 5
Day Lead
Time

APPLICATIONS:

- Clocks for a wide range of applications.

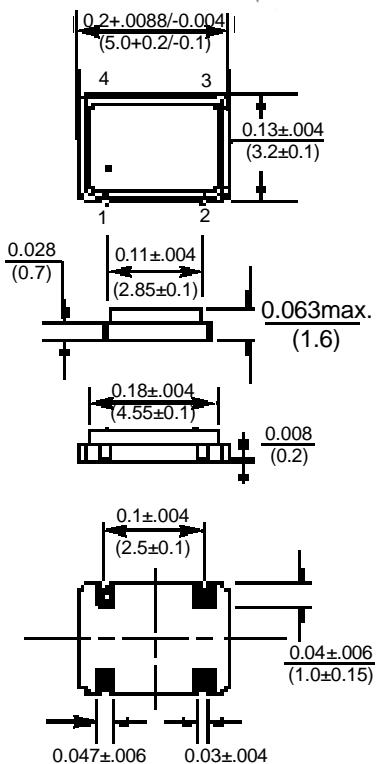
STANDARD SPECIFICATIONS

PARAMETERS	ASFP	ASFPT	ASFLP
Frequency Range (F ₀)	1.00MHz - 133MHz	1.00MHz - 106.25MHz	
Operating Temperature (T _{OPR})	-20°C to +70°C (See Options)		
Storage Temperature (T _{STO})	-55°C to +125°C		
Frequency Stability (ΔF / F ₀)	±50ppm max. (See Options)		
Supply Voltage (V _{dd})	5.0Vdc ±10%	3.3Vdc ±10%	
Input Current (I _{dd})	45mA max.	25mA max.	
Duty Cycle or Symmetry	45/55% max.at 1/2 VDD	45/55% max.at 1.4 VDC	45/55% max.at 1/2 VDD
Rise and Fall Times (T _R / T _F)		4ns max.	
Output Load	50pFmax.(F ≤ 66MHz) 25pFmax.(F ≤ 66MHz)	5TTL	30pFmax.(F ≤ 40MHz) 15pFmax.(F ≤ 40MHz)
Output Voltage (V _{OH})	0.9 *Vdd min.	2.4V min.	0.7 *Vdd min.
(V _{OL})	0.4V max.	0.4V max.	0.2 *Vdd max.
Start-up Time (T _{osc})		10ms max.	
Tristate (OE) Function	V _{IH} : 2.0V min. V _{IL} : 0.8V max.	Oscillation Hi Impedance	V _{IH} : 0.7*VDDmin. V _{IL} : 0.2*VDDmax.
Disable current OE (I _{DIS})	30mA max.		15mA max.
Stand-By current (option B)(I _{SB})	50µA max.		20µA max.
Jitter Peak to peak	±250ps max. for F ≤ 40MHz, ±90ps typ. ±100ps max. for F > 40MHz, ±50ps typ.		±250ps max. for F ≤ 40MHz, ±90ps typ. ±100ps max. for F > 40MHz, ±50ps typ.
RMS One sigma	±50ps max. for F ≤ 40MHz, ±25ps typ. ±30ps max. for F > 40MHz, ±15ps typ.		±50ps max. for F ≤ 40MHz, ±25ps typ. ±40ps max. for F > 40MHz, ±20ps typ.

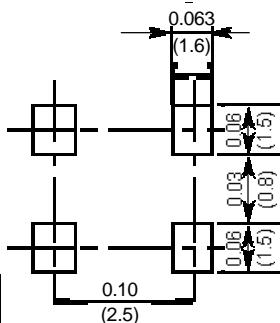
* Pin 1 has internal pull-up resistor which allow Pin 1 to be left floating (enable high). Connect a By-Pass capacitor 0.01 µF between Vdd and GND.

Environmental and mechanical specifications see appendix C. Group 2.
Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.
Tape and Reel, see appendix H.(1,000 pcs./reel).
Marking, see appendix G. Application notes, see appendix A.

Pin	Function
1	OE or PD
2	GND
3	Output
4	Vdd



Recommended land pattern



Dimensions: Inches (mm)

* Standard temperature only.
Please call us for other tighter spec.

ORDERING OPTIONS

ASFXPX - Frequency - Temperature - Overall Frequency Stability - Stand By - Packaging

Blank or L	XXX.XXX MHz
T or Blank	

-F for -30°C to +70°C
-N for -30°C to +85°C
-L for -40°C to +85°C

-J for ± 20ppm max.*
-R for ± 25ppm max.*
-K for ± 30ppm max.
-H for ± 35ppm max.

-B T for Tape and Reel

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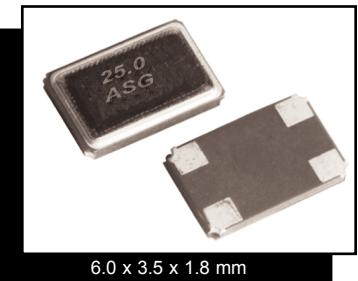
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HCMOS/TTL COMPATIBLE • CERAMIC SURFACE MOUNT

CRYSTAL CLOCK OSCILLATORS

ASG and ASGL



FEATURES:

- Compact and low in height.
- Low current consumption
- Tristate Enable/Disable function.
- Suitable for high density SMT., Reflow capable.
- Tight stability option.
- Seam welding.

APPLICATIONS:

- CCD clock for VTR camera.
- Equipment.
- Thin equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ASG	ASGL
Frequency Range (F ₀)	0.5MHz ~ 107MHz	0.5MHz ~ 125MHz
Operating Temperature (T _{OPR})	-10°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-55°C to +125°C	
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5.0Vdc ±10%	3.3Vdc ±10%
Input Current (I _{dd})	25mA max. for F < 40MHz 40mA max. for F < 70MHz 60mA max. for F ≤ 107MHz	20mA max. for F < 40MHz 35mA max. for F < 80MHz 50mA max. for F ≤ 125MHz
Duty Cycle or Symmetry	45 / 55% max. for F ≤ 50MHz 40 / 60% max. for F > 50MHz	40 / 60% max.
Rise and Fall Times (T _r / T _f)	10ns max. for F ≤ 40MHz 6ns max. for F > 40MHz	
Output Load	1.5pF (50pF max.)	5TTL or 15pF
Output Voltage (V _{oh}) (V _{ol})	0.9 * V _{dd} min. 0.1 * V _{dd} max.	
E/D Function (V _{iH}) (V _{iL})	"1" or Open: Oscillation "0": Output disabled in high impedance (Hi-Z)	≥ 2.2V < 0.8V

Connect a By-Pass capacitor 0.01 μF between V_{dd} and GND.

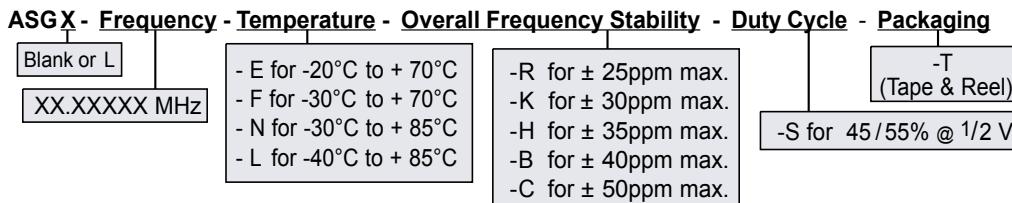
Environmental, and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G. Test circuit, waveforms, see appendix B.

Tape and Reel, see appendix H.(1,000 pcs/reel). Reflow profile, see appendix E.

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS



PIN NO.	FUNCTION
1	Tristate E/D
2	GND / Case
3	Output
4	V _{dd}

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7.0 x 5.08 x 1.8 mm

5.0 Vdc HCMOS / TTL COMPATIBLE CERAMIC SURFACE MOUNT CRYSTAL CLOCK OSCILLATORS **ASL and ASL1**

FEATURES:

- Leadless chip carrier (LCC), Low profile.
- HCMOS and TTL compatible.
- Tristate Enable/Disable function.
- Reflow capable.
- High density surface-mount applications.
- Available optional -40°C to 85°C extended temperature.
- Packaging: Tape and reel.
- Seam welding, 1.4 mm max.height.(ASL1)

APPLICATIONS:

- Provide clock signals for microprocessors, PC mainboards, Graphic cards.
- High output drive capability applications.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	1.00MHz - 125MHz
Operating Temperature (T _{OPR})	-10°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	5Vdc ±10%
Input Current (I _{dd})	25 mA max. for 1.0MHz < F < 35.0MHz 40 mA max. for 35.0MHz ≤ F ≤ 60.0MHz 60 mA max. for 60.0MHz < F ≤ 100MHz 80 mA max. for 100MHz < F ≤ 125MHz
Duty Cycle or Symmetry	40 / 60% max. @ 1/2 V _{dd} (See Options)
Rise and Fall Times (T _R / T _F)	10ns max. for 1.0MHz < F < 35.0MHz 5ns max. for 35.0MHz ≤ F < 100.0MHz 2.5ns max. for 100.0MHz ≤ F ≤ 125.0MHz
Output Load	10TTL or 50pF for F ≤ 70MHz 10TTL or 15pF for F > 70.0MHz
Output Voltage	0.9 * V _{dd} min. (V _{oh}); 0.4Vdc max. (V _{ol})
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{ih}) (V _{il})	"1" or Open: Oscillation ≥ 2.2V "0": Output disabled in high impedance (HiZ) < 0.8V
Period jitter one sigma	±25ps max.

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high)
A bypass capacitor 0.01 µF is required from V_{dd} to Gnd. Reflow profile, see appendix E.
Test circuit, waveforms, please see appendix B. Marking, see appendix G.
Environmental and mechanical specifications, see appendix C. Group 2.
Application notes, see appendix A. Tape and Reel, see appendix H.(1,000 pcs./reel)

ORDERING OPTIONS

ASLX - Frequency - Temperature - Overall Freq. Stability - Duty Cycle - 50 - Packaging

Blank or 1	XX.XXXXX MHz
	-I for -0°C to +50°C -D for -10°C to +60°C -E for -20°C to +70°C -F for -30°C to +70°C -N for -30°C to +85°C -L for -40°C to +85°C

-Y for ± 10ppm max.*
-J for ± 20ppm max.*
-R for ± 25ppm max.
-K for ± 30ppm max.
-H for ± 35ppm max.
-C for ± 50ppm max.

50pF load output drive	-T (Tape & Reel)
-S for 45/55% @ 1/2V _{dd}	
-S1 for 45/55% @ 1.4Vdc	

* Please contact us for availability.

Dimensions: Inches (mm)

PIN NO.	FUNCTION
1	Tristate E/D
2	GND / Case
3	Output
4	V _{dd}

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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3.3 Vdc • HCMOS/ TTL COMPATIBLE CERAMIC SURFACE MOUNT

CRYSTAL CLOCK OSCILLATORS

ASV and ASV1



7.0 x 5.08 x 1.8 mm

FEATURES:

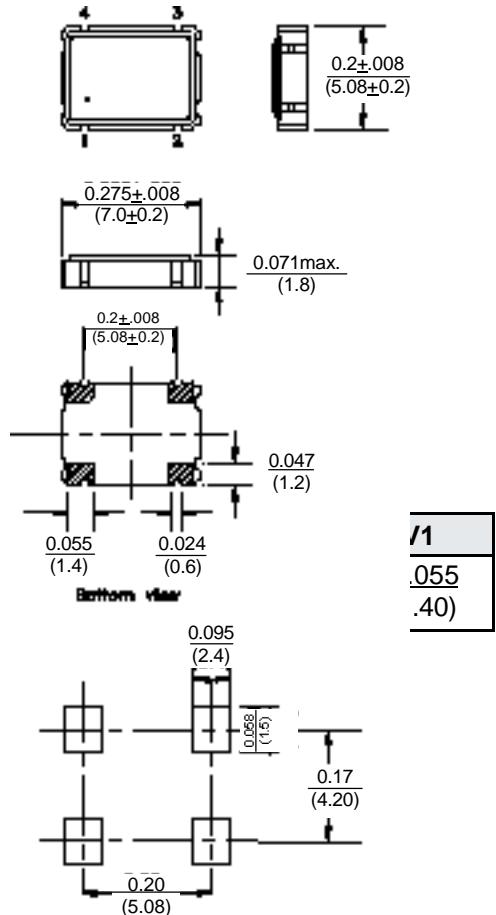
- Leadless chip carrier (LCC), Low profile.
- HCMOS and TTL Compatible, 3.3Vdc operation.
- Seam welding, 1.4 max. height (ASV1)
- Available optional -40°C to 85°C extended temperature.
- Tristate Enable / Disable function.
- Packaging: Tape and Reel.
- Seam welding, Reflow capable.

APPLICATIONS:

- Provide clock signals for microprocessors, PC mainboards, Graphic cards.
- High output drive capability applications.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	1.00MHz - 150MHz
Operating Temperature (T _{OPR})	-10°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF/ F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	3.3Vdc ±10%
Input Current (I _{dd})	10mA max. for F < 15MHz 16mA max. for F < 35MHz 25mA max. for F ≤ 60MHz 40mA max. for F < 100MHz 50mA max. for F ≤ 150MHz
Duty Cycle or Symmetry	40/60% max. @ 1/2Vdd (See Options)
Rise and Fall Times (T _R / T _F)	10ns max. for F < 35MHz / 5ns max for F < 100MHz 2.5ns max for F ≤ 150MHz
Output Load	5TTL or 15pF
Output Voltage (V _{OH})	0.9* V _{dd} min.
(V _{OL})	0.4Vdc max.
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{IH})	"1" or Open: Oscillation > 2.2V
(V _{IL})	"0": Output disabled in high impedance (HiZ) < 0.8V
Aging @ 25°C	±5ppm Max. per year
Period jitter one sigma	±25ps Max.



* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) Test circuit, waveform, please see appendix B.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs./reel).

A bypass capacitor 0.01 µF is required from V_{dd} to Gnd. Application notes, see appendix A.

ORDERING OPTIONS

ASVX - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Packaging			
Blank or 1	-I for -0°C to +50°C	-Y for ± 10ppm max.*	-T (Tape & Reel)
XXX.XXXXX MHz	-D for -10°C to +60°C	-J for ± 20ppm max.*	
	-E for -20°C to +70°C	-R for ± 25ppm max.	
	-F for -30°C to +70°C	-K for ± 30ppm max.	
	-N for -30°C to +85°C	-H for ± 35ppm max.	
	-L for -40°C to +85°C	-C for ± 50ppm max.	
			-S for 45/55% @ 1/2Vdd
			-S1 for 45/55% @ 1.4Vdc

* Please contact us for availability

PIN NO.	FUNCTION
1	Tristate E/D
2	GND / Case
3	Output
4	V _{dd}

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ABRACON®
CORPORATION

45
Rev. B
01/2003



7.3 x 5.08 x 1.05 mm

ULTRA LOW PROFILE • HCMOS/ TTL COMPATIBLE CERAMIC SURFACE MOUNT CRYSTAL CLOCK OSCILLATORS **ASL2 and ASV2**

FEATURES:

- Leadless chip carrier (LCC), 1.05 mm max. in height.
- HCMOS and TTL compatible, 5V or 3.3VDC.
- Tristate Enable/Disable function.
- Reflow capable.
- High density surface-mount applications.
- Available optional -40°C to 85°C extended temperature.
- Packaging: Tape and reel.
- Seam welding.

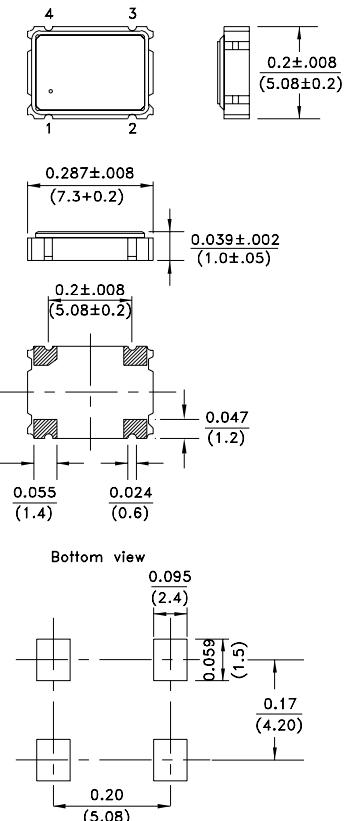
APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- High output drive capability applications.

STANDARD SPECIFICATIONS

PARAMETERS	ASL2	ASV2
Frequency Range (F ₀)	1.544MHz - 85.0MHz (Higher frequency available)	
Operating Temperature (T _{OPR})	-10°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-55°C to +125°C	
Frequency Stability (ΔF/ F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5Vdc ±10%	3.3Vdc ±10%
Input Current (I _{dd})	35mA max. for 1.544MHz ≤ F < 32.0MHz (15pF) 40mA max. (50pF) 45mA max. for 32.0 MHz ≤ F ≤ 85.0MHz 55mA max. (50pF)	25mA max. for 1.544MHz ≤ F < 32.0MHz 40mA max. for 32.0MHz ≤ F ≤ 85.0MHz
Duty Cycle or Symmetry	40 / 60% max. @ 1/2 V _{dd} (See Options)	
Rise and Fall Times (T _R / T _F)	10ns max. for 1.544MHz ≤ F < 32.0MHz 5ns max. for 32.0MHz ≤ F ≤ 85MHz	
Output Load	10TTL or 15 pF (50pF max.)	15pF or 2TTL
Output Voltage	0.9 * V _{dd} min. (V _{oh}) ; 0.1 * V _{dd} max. (V _{ol})	
Start-up Time (T _{osc})	10ms max.	
Tristate Function (V _{ih}) (V _{il})	"1" or Open: Oscillation ≥ 2.2V "0": Output disabled in high impedance (HiZ) < 0.8V	
Period jitter one sigma	±25ps max.	

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high)
A bypass capacitor 0.01 µF is required from V_{dd} to Gnd. Reflow profile, see appendix E.
Test circuit, waveforms, please see appendix B. Marking, see appendix G.
Environmental and mechanical specifications, see appendix C. Group 2.
Application notes, see appendix A. Tape and Reel, see appendix H.(1,000 pcs./reel).



Dimensions: Inches (mm)

ORDERING OPTIONS

ASX2 - Frequency - Temperature - Overall Freq. Stability - Duty Cycle - Packaging

L or V	XX.XXXXX MHz		-S for 45 / 55% @ 1/2Vdd	-T (Tape & Reel)
-I	for -0°C to + 50°C	-Y	for ± 10ppm max.*	
-D	for -10°C to + 60°C	-J	for ± 20ppm max.*	
-E	for -20°C to + 70°C	-R	for ± 25ppm max.	
-F	for -30°C to + 70°C	-K	for ± 30ppm max.	
-N	for -30°C to + 85°C	-H	for ± 35ppm max.	
-L	for -40°C to + 85°C	-C	for ± 50ppm max.	

* Please contact us for availability.

PIN NO.	FUNCTION
1	Tristate E/D
2	GND / Case
3	Output
4	V _{dd}

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5.0Vdc • HCMOS/TTL COMPATABLE • J-LEADED • PLASTIC MOLDED • SURFACE MOUNT

CRYSTAL CLOCK OSCILLATORS

ASM



14.0 x 8.95 x 4.7 mm

FEATURES:

- Industry standard J-leaded terminals.
- HCMOS and TTL compatible.
- Extended temperature -40°C to +85°C option.
- Plastic molded SMD.
- Tristate Enable/Disable.

APPLICATIONS:

- Wide range of applications in dialing communication equipment, AV / OA equipment, Measuring equipment.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	1.00MHz - 70.000MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-40°C to +85°C
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	5Vdc ±10%
Input Current (I _{dd})	25mA max. (F < 30MHz); 35mA max. (F > 30MHz)
Duty Cycle or Symmetry	45/55% max. for F ≤ 10 MHz 40/60% max. for F > 10 MHz (See Options & Note 1)
Rise and Fall Times (T _R / T _F)	8ns max. (F ≤ 40MHz); 6ns max. (F > 40MHz)
Output Load	10TTL max., 50pF max. (F ≤ 50MHz); 15pF (F > 50MHz)
Output Voltage (V _{OH})	2.4Vdc min. (TTL) ; 0.9*V _{dd} min. (HCMOS)
(V _{OL})	0.4Vdc max. (TTL) ; 0.1*V _{dd} max. (HCMOS)
Start-up Time (T _{osc})	10 ms max.
Output Disable / Enable	100 ns max. "1" or Open: Oscillation V _{IH} ≥ 2.0V "0": Output disabled in high impedance (HiZ) V _{IL} < 0.8V
Disabled current (I _{DIS})	28mA max
Aging	±5ppm / Year max.

Note 1: Option -S (Symmetry level measured at 1/2 V_{dd} for HCMOS, and at 1.4 Vdc for TTL).

Note 2: Pin 1 has internal pull-up resistor which allows pin 1 to be left floating (enable high). Connect a By-Pass capacitor 0.01 μF between V_{dd} and GND.

Test circuit, waveforms, see appendix B. Recommended handling, see appendix F.

Environmental and mechanical specifications, see appendix C. Group 2.

Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs./ reel).

Application notes, see appendix A. Reflow profile, see appendix E.

ORDERING OPTIONS

ASM - Frequency - Temperature - Frequency Stability - Duty Cycle - Packaging

XX.XXXXX MHz	-D for -10°C to +60°C -E for -20°C to +70°C -F for -30°C to +70°C -N for -30°C to +85°C -L for -40°C to +85°C	-S for 45/55% @ 1/2 V _{dd} -S1 for 45/55% @ 1.4 Vdc -R for ± 25ppm max. -K for ± 30ppm max. -H for ± 35ppm max. -C for ± 50ppm max.	-T (Tape & Reel)
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Dimensions: Inches (mm)

PIN NUMBER	FUNCTION
1	Tristate E/D
2	GND / Case
3	Output
4	V _{dd}

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14.0 x 8.95 x 4.7 mm

3.3 Vdc • HCMOS/TTL • J-LEADED • PLASTIC MOLDED • SURFACE MOUNT

CRYSTAL CLOCK OSCILLATORS

ASML

FEATURES:

- Industry standard J-Leaded terminals.
- Low current consumption.
- HCMOS output.
- Extended temperature -40°C to +85°C option.
- Plastic molded SMD, Reflow capable.
- Tristate Enable/Disable.
- 3.3Vdc operation.

APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- Communication equipment, AV and OA equipment

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	1MHz - 160MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-40°C to +85°C
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	3.3Vdc ±10%
Input Current (I _{dd})	10mA max. (F ≤ 20MHz) ; 25mA max. (F ≤ 70MHz) 60mA max. (F ≤ 160MHz)
Duty Cycle or Symmetry	40 / 60% max. (See Options)
Rise and Fall Times (T _R / T _F)	6ns max.
Output Load	2TTL, 15pF max.
Output Voltage (V _{OH})	0.9 *V _{dd} min.
(V _{OL})	0.4Vdc max.
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{IH})	"1" or Open: Oscillation ≥ 2.2V
(V _{IL})	"0": (HiZ) < 0.6V Output disabled in high impedance
Aging	±5ppm/ Year max.

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high). Test circuit, waveform, please see appendix B.

Environmental and mechanical specifications, see appendix C. Group 2.

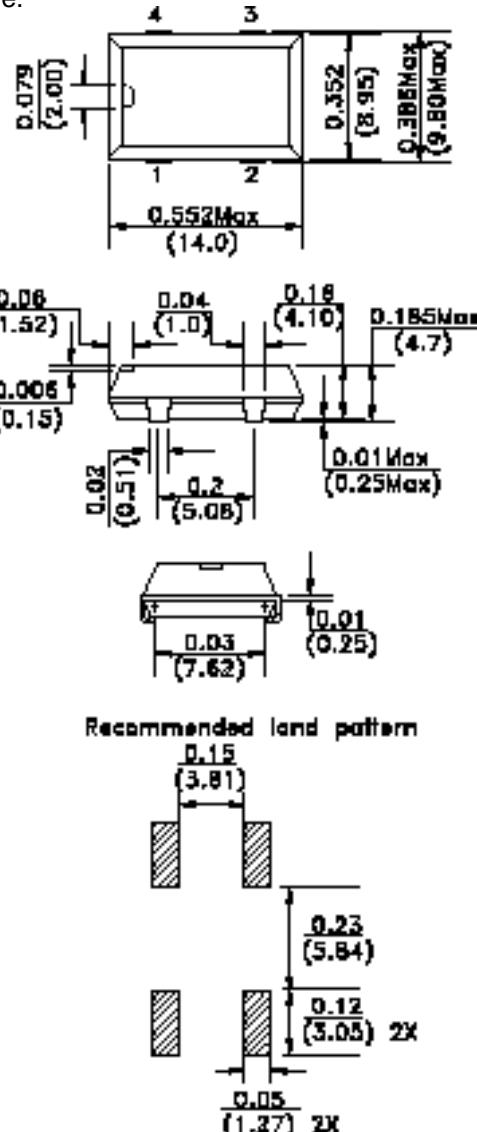
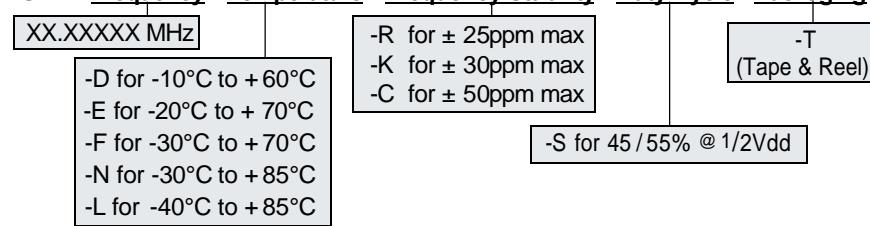
Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs./reel).

A bypass capacitor 0.01 µF is required from V_{dd} to Gnd.

Application notes, see appendix A. Reflow profile, see appendix E.

ORDERING OPTIONS

ASML - Frequency - Temperature - Frequency Stability - Duty Cycle - Packaging



Dimensions: Inches (mm)

PIN NO.	FUNCTION
1	Tristate Enable
2	GND / Case
3	Output
4	V _{dd}

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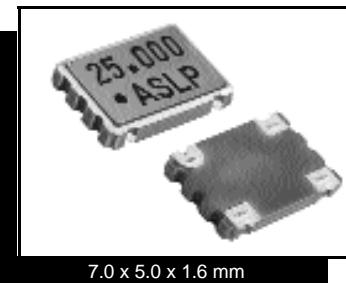
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5Vdc or 3.3Vdc • MINIATURE CERAMIC SURFACE MOUNT • HCMOS OR TTL

PROGRAMMABLE CLOCK OSCILLATORS

ASLP and ASVP



7.0 x 5.0 x 1.6 mm

FEATURES:

- Wide range of frequency up to 125MHz using PLL technology.
- Quick delivery within one to five days for small quantities.
- Ultra miniature low profile SMD package.
- Reflow soldering.
- Tristate E/D or Stand-By function.
- Hermetically seam welded.

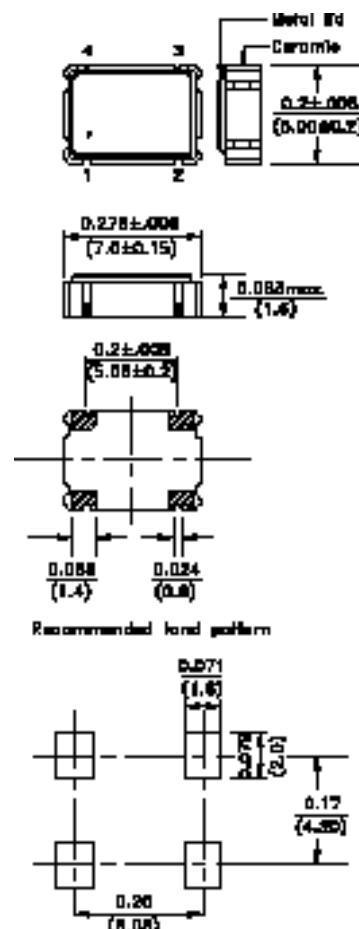
1 to 5
Day Lead
Time

APPLICATIONS:

- Clocks for a wide range of applications.

STANDARD SPECIFICATIONS

PARAMETERS	ASLP	ASLPT	ASVP
Frequency Range (F _o)	1.00MHz - 125MHz	1.00MHz - 106.25MHz	
Operating Temperature (T _{OPR})		-20°C to +70°C (See Options)	
Storage Temperature (T _{STO})		-55°C to +125°C	
Frequency Stability (ΔF/ F _o)		±50ppm max. (See Options)	
Supply Voltage (V _{dd})	5.0Vdc ±10%		3.3Vdc ±10%
Input Current (I _{dd})	45mA max.		25mA max.
Duty Cycle or Symmetry	45/55% max.at 1/2 VDD	45/55% max.at 1.4 VDC	45/55% max.at 1/2 VDD
Rise and Fall Times (T _R / T _F)		4ns max.	
Output Load	25pF max.	5TTL	15pF max.
Output Voltage (V _{OH})	0.9 *Vdd min.	2.4V min.	0.7 *Vdd min.
(V _{OL})	0.4V max.	0.4V max.	0.2 *Vdd max.
Start-up Time (T _{osc})		10ms max.	
Tristate (OE) Function	V _{IH} : 2.0V min. Oscillation V _{IL} : 0.8V max. Hi Impedance		V _{IH} : 0.7*VDDmin. V _{IL} : 0.2*VDDmax.
Disable current OE (I _{DIS})	30mA max.		15mA max.
Stand - By current (option B)(I _{STB})	50μA max.		20μA max.
Jitter Peak to peak	±250ps max. for F ≤ 40MHz, ±90ps typ. ±100ps max. for F > 40MHz, ±50ps typ.		±250ps max. for F ≤ 40MHz, ±90ps typ. ±100ps max. for F > 40MHz, ±50ps typ.
RMS One sigma	±50ps max. for F ≤ 40MHz, ±25ps typ. ±30ps max. for F > 40MHz, ±15ps typ.		±50ps max. for F ≤ 40MHz, ±25ps typ. ±40ps max. for F > 40MHz, ±20ps typ.



Dimensions: Inches (mm)

* Pin 1 has internal pull-up resistor which allow Pin 1 to be left floating (enable high).

Connect a By-Pass capacitor 0.01 μF between Vdd and GND.

Environmental and mechanical specifications see appendix C. Group 2.

Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.

Tape and Reel, see appendix H.(1,000 pcs./reel).

Marking, see appendix G. Application notes, see appendix A.

ORDERING OPTIONS

ASXPX	- Frequency	- Temperature	- Overall Frequency Stability	- Stand By	- Packaging
L or V	XXX.XXX MHz	-F for -30°C to +70°C -N for -30°C to +85°C -L for -40°C to +85°C	-J for ± 20ppm max.* -R for ± 25ppm max.* -K for ± 30ppm max. -H for ± 35ppm max.	-B	T for Tape and Reel
T or Blank					

* Standard temperature only.
Please call us for other tighter spec.

Pin	Function
1	OE or PD
2	GND
3	Output
4	Vdd

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5Vdc or 3.3Vdc • PLASTIC MOLDED J-LEADED SMD • HCMOS OR TTL

PROGRAMMABLE CLOCK OSCILLATORS

ASMP and ASMLP

1 to 5
Day Lead
Time

FEATURES:

- Wide range of frequency up to 125MHz using PLL Technology.
- Quick delivery within one to five days for small quantities.
- Miniature plastic SMD type.

- Reflow soldering.
- Tristate E / D or Stand-By function.
- Incorporated heat-resisting packaged crystal.

APPLICATIONS:

- Clocks for a wide range of applications.

STANDARD SPECIFICATIONS

PARAMETERS	ASMP	ASMPT	ASMLP
Frequency Range (F ₀)	1.00MHz - 125MHz	1.00MHz - 106.25MHz	
Operating Temperature (T _{OPR})	-20°C to +70°C (see option)		
Storage Temperature (T _{STO})	-55°C to +125°C		
Frequency Stability (ΔF/ F ₀)	±100ppm max. (see option)		
Supply Voltage (V _{dd})	5.0Vdc ± 10%	3.3Vdc ± 10%	
Input Current (I _{dd})	45mA max.	25mA max.	
Duty Cycle or Symmetry	45/55% max. at 1/2 VDD	45/ 55% max. at 1.4 VDC	45/55% max. at 1/2 VDD
Rise and Fall Times (T _R / T _F)		4ns max.	
Output Load	25 pF max.	5TTL	15 pF max.
Output Voltage (V _{OH})	0.9*V _{dd} min.	2.4V min.	0.7*V _{dd} min.
(V _{OL})	0.4V max.	0.4V max.	0.2*V _{dd} max.
Start-up Time (T _{osc})		10 ms max.	
Tristate (OE) Function	V _{IH} : 2.0V min. Oscillation V _{IL} : 0.8V max. Hi Impedance		V _{IH} : 0.7*VDDmin. V _{IL} : 0.2*VDDmax.
Disable current (I _{DIS})	30mA max.	15mA max.	
Stand - By current (Option - B)	50μA max.	20μA max.	
Jitter Peak to peak	± 250ps max. for F ≤ 33MHz, ±100ps typ. ± 100ps max. for F > 33MHz, ±50ps typ.	± 250ps max. for F ≤ 33MHz, ±100ps typ. ± 125ps max. for F > 33MHz, ±75ps typ.	
RMS One sigma	± 50ps max. for F ≤ 33MHz, ±30ps typ. ± 30ps max. for F > 33MHz, ±20ps typ.	± 50ps max. for F ≤ 33MHz, ±30ps typ. ± 30ps max. for F > 33MHz, ±20ps typ.	
Aging	±5ppm max./Year		

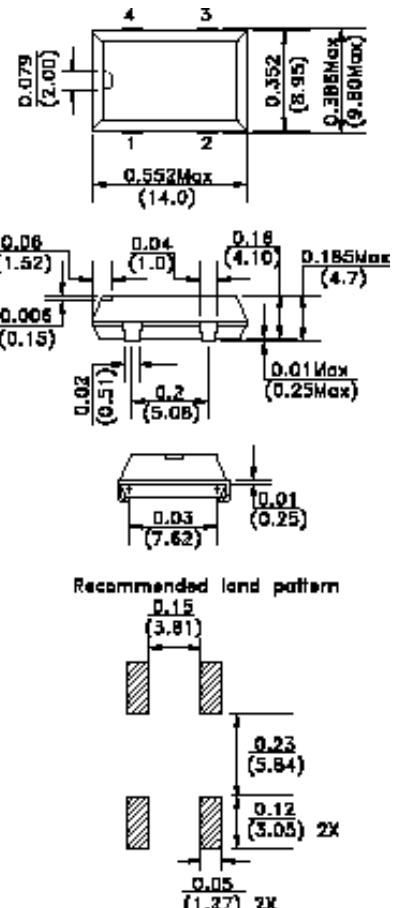
* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high).

Connect a By-Pass capacitor 0.01 μF between Vdd and GND.

Environmental, and mechanical specifications, see appendix C. Group 2.

Reflow profile, see appendix E. Tape and Reel, see appendix H.(1,000 pcs/reel)

Marking, see appendix G. Application notes, see appendix A.



Dimensions: Inches (mm)

Pin	Function
1	OE or PD
2	GND
3	Output
4	Vdd

* Standard temperature only. Please call us for other tighter spec.

ORDERING OPTIONS

ASMXPX	-	Temperature	-	Overall Frequency Stability	-	Stand By	-	Packaging
Blank	Blank	-F for -30°C to +70°C	-J for ± 20ppm max.*					
L	or T	-N for -30°C to +85°C	-R for ± 25ppm max.*					
		-L for -40°C to +85°C	-K for ± 30ppm max.					
			-H for ± 35ppm max.					
			-C for ± 50ppm max.					
						-B	T for Tape and Reel	

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**5Vdc • HCMOS/ TTL COMPATIBLE FULL-SIZE DIP
CRYSTAL CLOCK OSCILLATORS
ACO**



20.2 x12.6 x 5.08 mm

FEATURES:

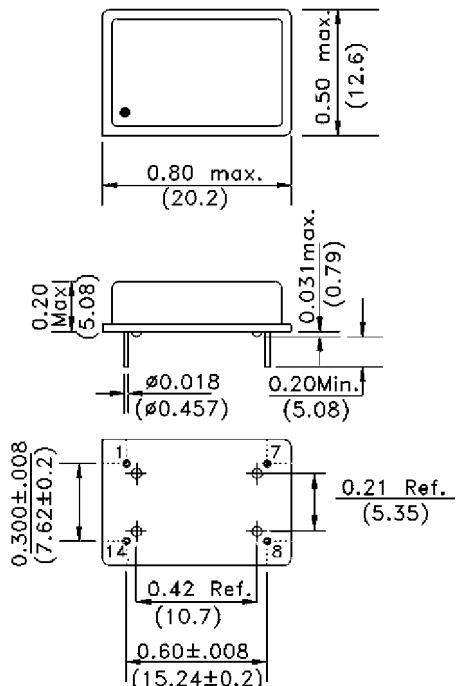
- Wide frequency range.
- Tight symmetry option.
- Fast rise and fall times.
- HCMOS and TTL compatible.
- Tristate Enable/Disable options.
- Anti-Static packaging tube.

APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- High output drive capability applications.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS	
Frequency Range (F ₀)	500Hz - 200MHz**	
Operating Temperature (T _{OPR})	0°C to +70°C	
Storage Temperature (T _{STO})	-55°C to +125°C	
Frequency Stability (ΔF/ F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{dd})	5Vdc ±10%	
Input Current (I _{dd})	30mA max. for F < 24MHz 45mA max. for F < 50MHz	70mA max. for F < 80MHz 85mA max. for F ≥ 80MHz
Duty Cycle or Symmetry	45 / 55% max. for F < 50MHz @ 1/2Vdd (See Options) 40 / 60% max. for F ≥ 50 MHz @ 1/2Vdd (See Options)	
Rise and Fall Times (T _R / T _F)	10ns max. for F ≤ 24MHz 5ns max. for F > 24MHz	
Output Load	10TTL or 15pF (50pF max.) for F ₀ < 80MHz 5TTL or 15pF for (F ₀) ≥ 80MHz	
Output Voltage	0.9*Vdd min. (V _{OH}) ; 0.4Vdc max. (V _{OL})	
Start-up Time (T _{osc})	10ms max.	
Tristate Function (V _{IH}) (Option -A Only) (V _{IL})	"1" or Open: Oscillation "0": Output disabled in high impedance (HiZ) ≥ 2.2V < 0.8V	
Output Disable / Enable Time	100ns max. (for Option "- A" ONLY)	



Dimensions: Inches (mm)

PIN NUMBER	FUNCTION
1	NC or Tristate E/D
7	GND / Case
8	Output
14	V _{dd}

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) Option A

** Higher Frequencies available. Recommended handling, see appendix F.

Test circuit, waveforms, see appendix B. Reflow profile, see appendix E.

Environmental and mechanical specifications, see appendix C. Group 1. Marking, see appendix G.

Application notes, see appendix A. Value added, see appendix D.

ORDERING OPTIONS

ACO - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Tristate - 50 - Value Added - Packaging

XX.XXXX MHz or kHz

-Y for ± 10ppm max**
-J for ± 20ppm max
-R for ± 25ppm max
-K for ± 30ppm max
-H for ± 35ppm max
-C for ± 50ppm max

-S for 45 / 55% @ 1/2Vdd
-T for 47.5 / 52.5% @ 1/2Vdd
-S1 for 45 / 55% @ 1.4Vdc
-T1 for 47.5 / 52.5% @ 1.4Vdc

- A for Tristate E/D

50 pF load output drive

-TY for Tray packing

-G Gull Wing
-GHT Gull Wing Reflow capable
-QXX (Trimmed Leads)

** Standard Operating Temperature Only Frequency 50 MHz max

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20.2 x 12.6 x 5.08 mm

3.3Vdc • HCMOS/ TTL COMPATIBLE FULL-SIZE AND HALF-SIZE DIP

CRYSTAL CLOCK OSCILLATORS

ACOL and ACHL

FEATURES:

- Tristate Enable /Disable option.
- HCMOS and TTL compatible.
- Low power
- Low voltage 3.3Vdc.
- Tight symmetry option.

APPLICATIONS:

- Clock signal sources for digital chips and microprocessors.
- Low power applications.

STANDARD SPECIFICATIONS

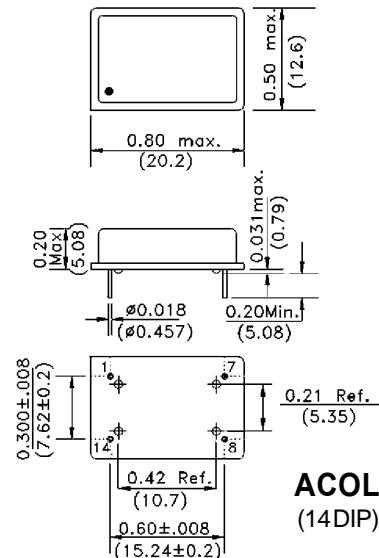
PARAMETERS	SPECIFICATIONS
Package Type	ACOL (14DIP) and ACHL (8DIP)
Frequency Range (F ₀)	32.768 kHz - 200 MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF / F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	3.3Vdc ±10%
Input Current (I _{dd})	20mA max. for F ≤ 20 MHz 25mA max. for F ≤ 70 MHz 50mA max. for F ≤ 200 MHz
Duty Cycle or Symmetry	40/60% max. (typical 45/55%) (See Options)
Rise and Fall Times (T _R / T _F)	10ns max.
Output Load	5TTL or 15pF
Output Voltage	0.9*V _{dd} min. (V _{OH}) ; 0.1*V _{dd} max. (V _{OL})
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{IH})	"1" or Open: Oscillation ≥ 2.2V
(Option "-A" ONLY) (V _{IL})	"0": Output disabled in high impedance (HiZ) < 0.8V
Output Disable / Enable Time	100ns max. (for Option "- A" ONLY)

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) opt. A. Test circuit, waveforms, see appendix B. Recommended handling, see appendix F.

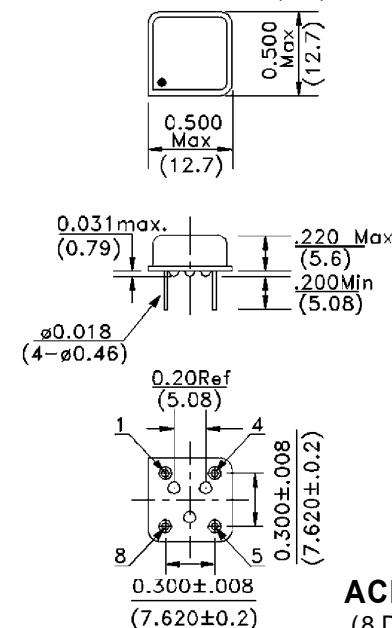
Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Value added, see appendix D.

Application notes, see appendix A.



Dimensions: Inches (mm)



ACHL
(8 DIP)

ORDERING OPTIONS

ACXL - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Tristate - Value Added - Packaging

O or H	XX.XXXXX MHz or kHz
-D for -10°C to +60°C	
-E for -20°C to +70°C	
-F for -30°C to +70°C	
-N for -30°C to +85°C	
-L for -40°C to +85°C	

-Y for ± 10 ppm max**
-J for ± 20 ppm max
-R for ± 25 ppm max
-K for ± 30 ppm max
-H for ± 35 ppm max
-C for ± 50 ppm max

-S for ± 10 ppm max**
-T for 47.5/52.5% @ 1/2 Vdd
-S1 for 45/55% @ 1.4 Vdc

- A for Tristate E/D

-G Gull Wing*
-G2 Gull Wing * (ACHL Only)
-QXX (Trimmed Leads) *

-T for Tape and reel
-TY for Tray packing

PIN # ACOL	PIN # ACHL	FUNCTION
1	1	NC or E/D
7	4	GND / Case
8	5	Output
14	8	Vdd

** Standard Operating
Temperature Only
Frequency 50 MHz max

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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2.5Vdc • HCMOS / TTL COMPATIBLE FULL-SIZE AND HALF-SIZE DIP

CRYSTAL CLOCK OSCILLATORS

ACOL1 and ACHL1



20.2 x 12.6 x 5.08 mm

FEATURES:

- Tristate Enable/Disable option.
- HCMOS and TTL compatible.
- Anti-Static packaging tubes.
- Low voltage 2.5Vdc.
- Tight symmetry option.
- Low power.

APPLICATIONS:

- Clock signal sources for digital chips and microprocessors.
- Low power applications.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Package Type	ACOL1 (14DIP) and ACHL1 (8DIP)
Frequency Range (F ₀)	1.00MHz - 85.0MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF/F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	2.5Vdc ±10%
Input Current (I _{dd})	15mA max.
Duty Cycle or Symmetry	40/60% max. (typical 45/55%) (See Options)
Rise and Fall Times (T _R / T _F)	10ns max.
Output Load	5TTL or 15pF
Output Voltage	0.9 *V _{dd} min. (V _{OH}) 0.1 *V _{dd} max. (V _{OL})
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{IH}) "1" or Open: Oscillation ≥ 1.8V (Option "-A" ONLY) (V _{IL}) "0": Output disabled in high impedance (HiZ) < 0.4V	
Output Disable / Enable Time	100ns max. (for Option "- A" ONLY)

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) opt. A. Test circuit, waveforms, see appendix B. Recommended handling, see appendix F. Environmental and mechanical specifications, see appendix C. Group 1. Marking, see appendix G. Value added, see appendix D. Application notes, see appendix A.

ORDERING OPTIONS

ACXL1 - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Tristate - Value Added - Packaging

O or H
XX.XXXXX MHz or kHz
-D for -10°C to + 60°C
-E for -20°C to + 70°C
-F for -30°C to + 70°C
-N for -30°C to + 85°C
-L for -40°C to + 85°C

-R for ± 25ppm max
-K for ± 30ppm max
-H for ± 35ppm max
-C for ± 50ppm max

-S for 45/55% @ 1/2V_{dd}

-A for Tristate E/D

-G Gull Wing
-G2 Gull Wing (ACHL1)
-QXX (Trimmed Leads)

-T for Tape and reel
-TY for Tray packing

PIN # ACOL1	PIN # ACHL1	FUNCTION
1	1	NC or E/D
7	4	GND / Case
8	5	Output
14	8	V _{dd}

** Standard Operating Temperature Only.

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12.7 x 12.7 x 5.6 mm

5Vdc • HCMOS/TTL COMPATIBLE HALF-SIZE DIP CRYSTAL CLOCK OSCILLATORS

ACH

FEATURES:

- Wide frequency range.
- Tight symmetry option.
- Fast rise and fall times.
- HCMOS and TTL compatible.
- Tristate Enable / Disable function.
- Anti-Static packaging tube.

APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- High output drive capability applications.

STANDARD SPECIFICATIONS

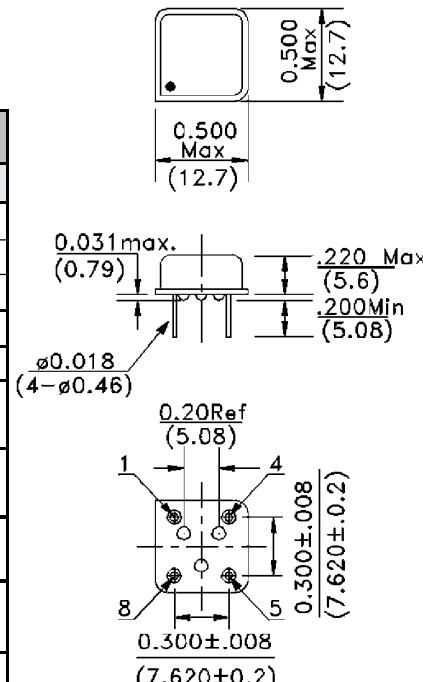
PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	32.768kHz - 200MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF/F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	5Vdc ±10%
Input Current (I _{dd})	30mA max. for F < 24MHz 70mA max. for F < 80MHz 45mA max. for F < 50MHz 85mA max. for F ≥ 80MHz
Duty Cycle or Symmetry	45 / 55% max. for F < 50MHz @ 1/2V _{dd} (See Options) 40 / 60% max. for F ≥ 50MHz @ 1/2V _{dd} (See Options)
Rise and Fall Times (T _R / T _F)	10ns max. for F ≤ 24MHz 5ns max. for F > 24MHz
Output Load	10TTL or 15pF (50pF max.) for F ₀ < 80MHz 5TTL or 15pF for (F ₀) ≥ 80MHz
Output Voltage	0.9 *V _{dd} min. (V _{OH}) ; 0.4Vdc max. (V _{OL})
Start-up Time (T _{osc})	10ms max.
Tristate Function (V _{IH}) (Option "A" ONLY) (V _{IL})	"1" or Open: Oscillation ≥ 2.2V "0": Output disabled in high impedance (HiZ) < 0.8V
Output Disable / Enable Time	100ns max. (for Option "- A" ONLY)

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) Option A. Test circuit, waveforms, see appendix B..

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Recommended handling, see appendix F.

Application notes, see appendix A. Reflow profile see appendix E.



Dimensions: Inches (mm)

PIN NUMBER	FUNCTION
1	NC or Tristate E/D
4	GND / Case
5	Output
8	V _{dd}

ORDERING OPTIONS

ACH - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Tristate - 50 - Value Added - Packaging

XX.XXXX MHz or kHz	-Y for ± 10ppm max** -J for ± 20ppm max -R for ± 25ppm max -K for ± 30ppm max -H for ± 35ppm max -C for ± 50ppm max	-S for 45 / 55% @ 1/2V _{dd} -T for 47.5 / 52.5% @ 1/2V _{dd} -S1 for 45 / 55% @ 1.4Vdc -T1 for 47.5 / 52.5% @ 1.4Vdc	- A for Tristate E/D	50pF load output drive	-T for tape and reel -TY for Tray packing
-D for -10°C to +60°C -E for -20°C to +70°C -F for -30°C to +70°C -N for -30°C to +85°C -L for -40°C to +85°C				-G Gull Wing -G2 Gull Wing -GHT Gull Wing Reflow capable -QXX (Trimmed Leads)	

** Standard Operating Temperature Only Frequency 50 MHz max.

5Vdc • TTL OUTPUT • FULL-SIZE AND HALF-SIZE DIP

CRYSTAL CLOCK OSCILLATORS

ACT and AHT



20.2 x 12.6 x 5.08 mm

FEATURES:

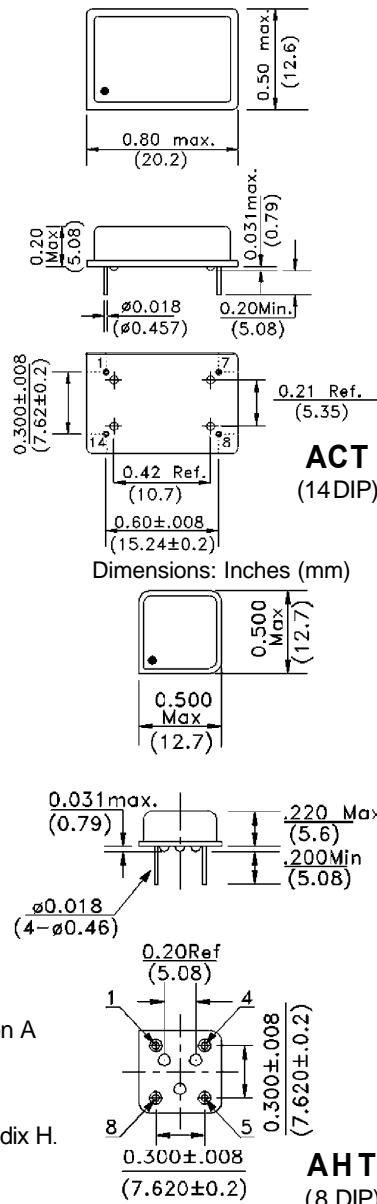
- Hermetically sealed metal package.
- Case ground for EMI protection.
- TTL output.
- Tristate Enable/Disable options.

APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- TTL output for low EMI applications.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Package Type	ACT (14 DIP) and AHT (8 DIP)
Frequency Range (F ₀)	500kHz - 70MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF/ F ₀)	±100ppm max. (See Options)
Supply Voltage (V _{dd})	5Vdc ±10%
Input Current (I _{dd})	30mA max. F ₀ ≤ 25MHz (Without Load) 70mA max. F ₀ ~ 25.01MHz - 70MHz
Duty Cycle or Symmetry (at 1.4 Vdc)	45/ 55% max. for F ≤ 8.0MHz 40/ 60% max. for F > 8.0MHz (See Options)
Rise and Fall Times (T _R / T _F)	10ns max. for F ≤ 30MHz 6ns max. for F > 30MHz (See Options)
Output Load	10TTL max.
Output Voltage (V _{OH})	2.4Vdc min.
(V _{OL})	0.4Vdc max.
Start-up Time (T _{Osc})	10ms max.
Tristate Function (V _{IH}) (Option "A" ONLY)	"1" or Open: Oscillation ≥ 2.2V
(V _{IL})	"0": Output disabled in high impedance (HiZ) < 0.8V
Output Disable/ Enable Time	100ns max. (for Option "- A" ONLY)



* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high) Option A Test circuit, waveforms, see appendix B. Recommended handling, see appendix F.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Value added, see appendix D.

Application notes, see appendix A. Reflow profile, see appendix E. Packaging, see appendix H.

ORDERING OPTIONS

AXT - Frequency - Temperature - Overall Frequency Stability - Duty Cycle - Tristate - Value Added - Packaging

C or H				-S for 45 / 55% -T for 47.5 / 52.5%	- A Tristate E/D	-T Tape and reel -TY tray packing
XX.XXXXXMHz						
-D for -10°C to +60°C						
-E for -20°C to +70°C						
-F for -30°C to +70°C						
-N for -30°C to +85°C						
-L for -40°C to +85°C						
	-J for ± 20ppm max					
	-R for ± 25ppm max					
	-K for ± 30ppm max					
	-H for ± 35ppm max					
	-C for ± 50ppm max					
		-G Gull Wing*				
		-G2 Gull Wing (AHT)				
		-GHT Gull Wing reflow capable*				
		-QXX (Trimmed Leads)*				
PIN # ACT	PIN # AHT	FUNCTION				
1	1	NC or Tristate E/D				
7	4	GND / Case				
8	5	Output				
14	8	V _{dd}				

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20.2 x 12.6 x 7.2 mm

DOUBLE SEALED, HIGH PRECISION, WIDE RANGE FREQUENCY, 5.0Vdc • TTL/HCMOS FULL-SIZE DIP

CRYSTAL CLOCK OSCILLATORS

ADCO and ADCO1

FEATURES:

- Double sealed DIP package.
- Tight overall frequency stability.
- Enable/Disable and extra output options.
- High-precision UM internal crystal.
- Wide frequency range.

APPLICATIONS:

- High-Precision clock signals for microprocessors and digital circuits.
- Data telecommunications and networking.

STANDARD SPECIFICATIONS

PARAMETERS	ADCO	ADCO1
Frequency Range (F ₀)	20MHz - 150MHz	12MHz - 35MHz
Operating Temperature (T _{OPR})	0°C to +70°C (see options)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability ($\Delta F / F_0$)		
-vs- Temperature	±20ppm max. (see options)	
-vs- Supply	±0.5ppm max. (Vdd ± 5%)	
-vs- Load	±0.2ppm max. (± 10% load)	
-vs- Aging	±1.0ppm max (first year)	
Supply Voltage (Vdd)	+5Vdc ±5%	
Supply Current (Idd)	20mA max.	40mA max.
Duty cycle or Symmetry	40/60% max. measured at 1/2Vdd or 1.4VDC	
Rise and Fall times (Tr/Tf)	10ns max. for F ≤ 24MHz; 5ns max. for F>24MHz	
Output	TTL/HCMOS Square Wave	
Output and E/D options (pin 1)	No connection or E/D option (-A)	Output 2
Output load	2TTL or 15PF	
Output voltage	VOH = 0.9 *VDD min. VOL = 0.4VDC max.	
Enable/Disable option (pin 1)	VIL= 1.68V max., VIH = 2.2V min.	N/A
Start-up time	10ms max.	

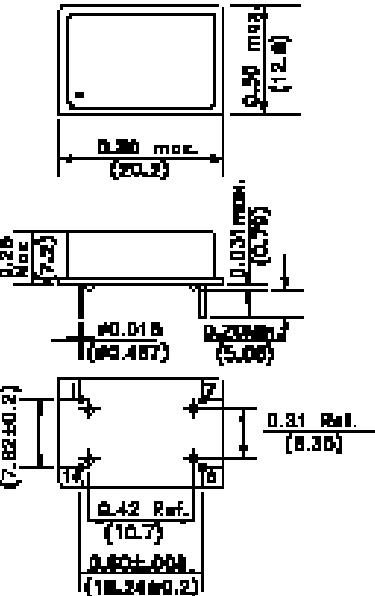
* Pin 1 has internal pull-up resistor.

Environmental and mechanical specifications, see appendix C.Group 1.

Marking, see appendix G. Recommended handling, see appendix F.

Test circuits and waveform, see appendix B

Application notes, see appendix A. Value added, see appendix D.



Dimensions: Inches (mm)

PIN NO.	ADCO	ADCO1
1	NC or E/D	OUTPUT2
7	GND	GND
8	OUTPUT	OUTPUT1
14	VDD	VDD

ORDERING OPTIONS

ADCOX - Frequency - Temperature - Overall Frequency Stability - Pin 1 option - Value Added

Blank or 1
XX.XXXX MHz

-D for -10°C to + 60°C
-E for -20°C to + 70°C
-F for -30°C to + 70°C
-N for -30°C to + 85°C
-L for -40°C to + 85°C

Blank = N/C
-A = Enable/Disable**
-R5 for ± 5 ppm max.
-Y for ± 10 ppm max
-R15 for ± 15 ppm max

-G Gull Wing
-QXX (Trimmed Leads)

** ADCO Only

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5Vdc • SINE OUTPUT, FULL-SIZE DIP

CRYSTAL CLOCK OSCILLATORS ACOS



FEATURES:

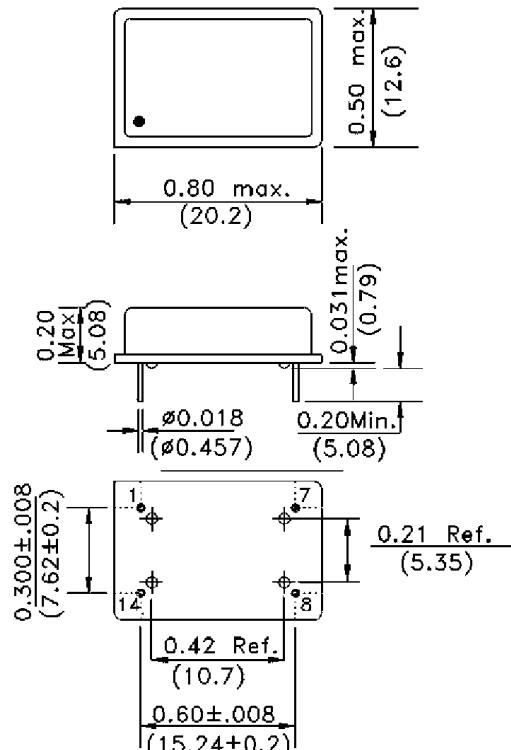
- Sine wave output.
- Wide Frequency Range.
- Low harmonic distortion.

APPLICATIONS:

- Provide clock signals for microprocessors and digital circuits.
- High Output drive capability applications.
- Great for low EMI applications.

STANDARD SPECIFICATIONS

Frequency Range	8MHz - 40MHz
Operating Temperature	0°C to +70°C (see options)
Storage Temperature	-55°C to +125°C
Frequency Stability	±100ppm max. (See Options)
Supply Voltage	5.0Vdc ±10%
Output load	50Ω
Output power	0dBm min.
Harmonics	-25dBC min.
Aging	±5ppm/yr. max.



Dimensions: Inches (mm)

ORDERING OPTIONS

ACOS - Frequency - Temperature - Overall Frequency Stability - Value Added - Packaging

XX.XXXXMhz

-D for -10°C to + 60°C
-E for -20°C to + 70°C
-F for -30°C to + 70°C
-N for -30°C to + 85°C
-L for -40°C to + 85°C

-R for ± 25ppm max
-K for ± 30ppm max
-H for ± 35ppm max
-C for ± 50ppm max

-G Gull Wing
-QXX (Trimmed Leads)

-TY for Tray packing

PIN NUMBER	FUNCTION
1	NC
7	GND / Case
8	Output
14	Vcc

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20 x 12.6 x 7.2 mm

FUNDAMENTAL FREQUENCY, LOW JITTER 5.0V or 3.3Vdc FULL-SIZE DIP CRYSTAL CLOCK OSCILLATORS ACPE and ACPEL

FEATURES:

- Low jitter PECL logic.
- Tight overall frequency stability.
- Fast rise and fall times.
- Complementary output.
- Wide frequency range.

APPLICATIONS:

- Gigabit ethernet.
- Data telecommunications and networking.
- xDSL, Stratum IV.
- SONET/SDH.

STANDARD SPECIFICATIONS

PARAMETERS	ACPE	ACPEL
Frequency Range (F ₀)	10.00MHz - 200MHz	
Operating Temperature (T _{OPR})	0°C to +70°C (see options)	
Storage Temperature (T _{STO})	-55°C to +105°C	
Frequency Stability (ΔF/ F ₀)	±100ppm max. (See Options)	
Supply Voltage (V _{cc})	+5Vdc ±5%	+3.3Vdc ±5%
Supply Current (I _{dd})	100mA max.	
Duty cycle or Symmetry	40/60% max. measured 50% waveform	
Rise and Fall times (Tr/Tf)	2ns max. measured at 20% to 80% level	
Output	PECL square wave 10KH compatible	
Output and E/D options (pin 1)	No connection or Complementary output or E/D	
Output load	50Ω terminated into 3VDC or Thevenin equivalent	
Output voltage	VOH = V _{cc} -1.025V min., V _{cc} - 0.74V max. VOL = V _{cc} -1.95V min., V _{cc} - 1.60V max.	
Period Jitter	3.5ps RMS max.	
Enable/Disable option (pin 1)	VIL= V _{cc} -1.62V max., VIH = V _{cc} -1.025V min. (Output is in "0" state when disabled)	
Start-up time	10ms max.	

* Output must be terminated into 50Ω to +3VDC or Thevenin equivalent.

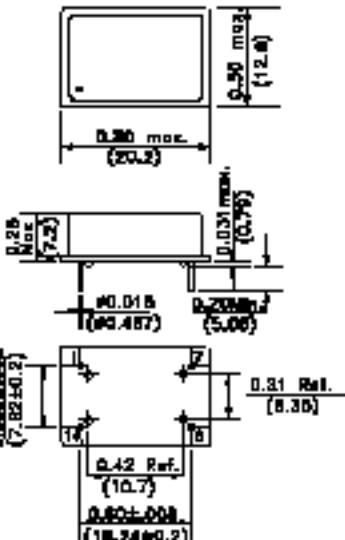
Environmental and mechanical specifications, see appendix C. Group 1.

Value added, see appendix D.

Test circuit and waveforms, see appendix B

Marking, see appendix G. Recommended handling, see appendix F.

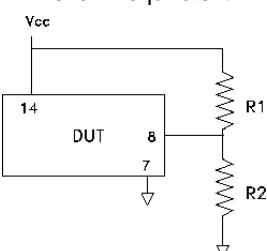
Application notes, see appendix A.



Dimensions: Inches (mm)

PIN NUMBER	FUNCTION
1	NC or \bar{Q} or E/D
7	GND / Case
8	Output
14	V _{cc}

Thevenin equivalent



V _{cc}	R1	R2
5.0V	82Ω	130Ω
3.3V	130Ω	82Ω

ORDERING OPTIONS

ACPEX - Frequency - Temperature - Overall Frequency Stability - Pin 1 option - Value Added

Blank or L

XX.XXXX MHz

-D for -10°C to +60°C
-E for -20°C to +70°C
-F for -30°C to +70°C
-N for -30°C to +85°C
-L for -40°C to +85°C

-Y for ± 10ppm max.
-J for ± 20ppm max.
-R for ± 25ppm max.
-K for ± 30ppm max.
-H for ± 35ppm max.
-C for ± 50ppm max.

-Blank = N/C
-QBAR = Complementary output
-A = Enable/Disable

-G Gull Wing
-QXX (Trimmed Leads)



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5Vdc or 3.3Vdc • FULL-SIZE and HALF-SIZE DIP • HCMOS OR TTL

PROGRAMMABLE CLOCK OSCILLATORS

ACOP and ACHP series



20.2 x 12.6 x 5.08 mm

FEATURES:

- Wide range of frequency up to 125MHz using PLL Technology.
- Quick delivery within one to five days for small quantities.
- Tristate E /D or Stand-By function.

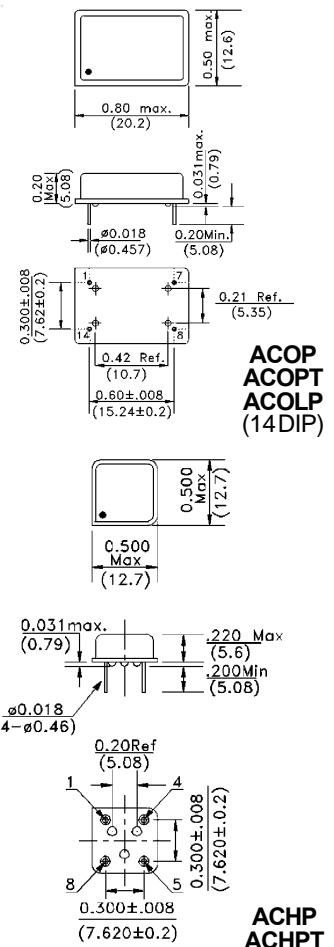
1 to 5
Day Lead
Time

APPLICATIONS:

- Clocks for a wide range of applications.

STANDARD SPECIFICATIONS

PARAMETERS	ACOP ACHP	ACOPT ACHPT	ACOLP ACHLP
Frequency Range (F ₀)	1.00MHz - 125MHz	1.00MHz - 106.25MHz	
Operating Temperature (T _{OPR})	-20°C to +70°C (see option)		
Storage Temperature (T _{STO})	-55°C to +125°C		
Frequency Stability (ΔF/ F ₀)	±100ppm max. (see option)		
Supply Voltage (V _{dd})	5.0Vdc ± 10%	3.3Vdc ± 10%	
Input Current (I _{dd})	45mA max.	25mA max.	
Duty Cycle or Symmetry	45/55% max.at 1/2 VDD	45/ 55% max.at 1.4 VDC	45/55% max.at 1/2 VDD
Rise and Fall Times (T _R / T _F)		4ns max.	
Output Load	25 pF max.	5TTL	15 pF max.
Output Voltage (V _{OH})	0.9*V _{dd} min.	2.4V min.	0.7*V _{dd} min.
(V _{OL})	0.4V max.	0.4V max.	0.2*V _{dd} max.
Start-up Time (T _{osc})		10 ms max.	
Tristate (OE) Function	V _{IH} : 2.0V min. Oscillation V _{IL} : 0.8V max. Hi Impedance		V _{IH} : 0.7*VDDmin. V _{IL} : 0.2*VDDmax.
Disable current (I _{DIS})	30mA max.		15mA max.
Stand - By current (Option - B)	50μA max.		20μA max.
Jitter Peak to peak	± 250ps max. for F ≤ 33MHz, ±100ps typ. ± 100ps max. for F >33MHz, ±50ps typ.		± 250ps max. for F ≤ 33MHz, ±100ps typ. ± 125ps max. for F >33MHz, ±75ps typ.
RMS One sigma	± 50ps max. for F ≤ 33MHz, ±30ps typ. ± 30ps max. for F >33MHz, ±20ps typ.		± 50ps max. for F ≤ 33MHz, ±30ps typ. ± 30ps max. for F >33MHz, ±20ps typ.
Aging		±5ppm max./Year	



Dimensions:
Inches (mm)

PIN #	PIN #	FUNCTION
ACOP	ACHP	
ACOPT	ACHPT	
ACOLP	ACHLP	
1	1	OE or PD
7	4	GND
8	5	Output
14	8	Vdd

* Pin 1 has internal pull-up resistor which allows Pin 1 to be left floating (enable high).

Connect a By-Pass capacitor 0.01 μF between Vdd and GND.

Environmental, and mechanical specifications, see appendix C. Group 1.

Reflow profile, see appendix E. Tape and Reel, see appendix H.

Marking, see appendix G. Application notes, see appendix A. Value added, see appendix D.

ORDERING OPTIONS

ACXXPX -	Temperature	Overall Frequency Stability	Stand By	Value added	Packaging
O or H Blank L	Blank or T	-F for -30°C to +70°C -N for -30°C to +85°C -L for -40°C to +85°C	-J for ± 20ppm max.* -R for ± 25ppm max.* -K for ± 30ppm max. -H for ± 35ppm max. -C for ± 50ppm max.	-B	-G Gull Wing -G2 Gull Wing -GHT Gull Wing Reflow capable -QXX (Trimmed Leads)
					-T Tape and Reel -TY Tray packing

* Standard temperature only. Please call us for other tighter spec.

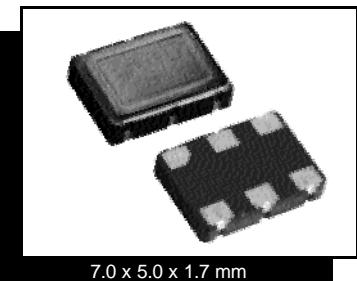
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7.0 x 5.0 x 1.7 mm

MINIATURE CERAMIC • HCMOS• SURFACE MOUNT• 5Vdc or 3.3Vdc VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS ASLV and ASVV Series

FEATURES:

- Low profile (1.7 mm) ceramic VCXO.
- Enable / Disable functions.
- 7.0 mm x 5.0 mm seam welded.
- 5Vdc or 3.3Vdc.
- Suitable for reflow methods.
- HCMOS/TTL output.

APPLICATIONS:

- Phase locked loops (PLLs).
- Synthesizers.
- Clock Recover, Digital transmission device.
- Digital set-top box.

STANDARD SPECIFICATIONS

PARAMETERS	ASLV	ASVV
Frequency Range (F ₀)	1.544MHz - 60.00MHz (See Note)	
Operating Temperature (T _{OPR})	0°C to +70°C (See Option)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability (ΔF/F ₀)	±50ppm max. (See Options)	
Supply Voltage (V _{dd})	5Vdc ±5%	3.3Vdc ±5%
Input Current (I _{dd})	10mA max. for F ≤ 20MHz 20mA max. for F ≤ 40MHz 30mA max. for F ≤ 60MHz	10mA max. for F ≤ 20MHz 15mA max. for F ≤ 40MHz 25mA max. for F ≤ 60MHz
Duty Cycle or Symmetry	40 / 60% max. (See Options)	
Rise and Fall Times (T _R / T _F)	8ns max.	
Output Load	15pF or 2TTL	
Output Voltage (V _{OH})	0.9 *V _{dd} min.	
(V _{OL})	0.1*V _{dd} max.	
Transfer Function	Positive	
Voltage Control (V _c)	2.5Vdc ±2.0V	1.65Vdc ±1.5V
Frequency Deviation	±100ppm min. (See options)	±80ppm min. (See options)
Linearity	±10% max.	
Start-up Time (T _{osc})	10ms max.	
Tristate Function (V _{IH})	'1' OR OPEN: OSCILLATION ≥ 2.2V	
(V _{IL})	'0' (HZ) < 0.8V	
Period jitter one sigma	±10ps max.	
Period jitter absolute	±100ps max.	

A bypass capacitor 0.01 μF is required from V_{dd} to Gnd.

Please call us for higher frequencies. Test circuit, waveforms, see appendix B.

Environmental and mechanical specifications see appendix C, Group 2.

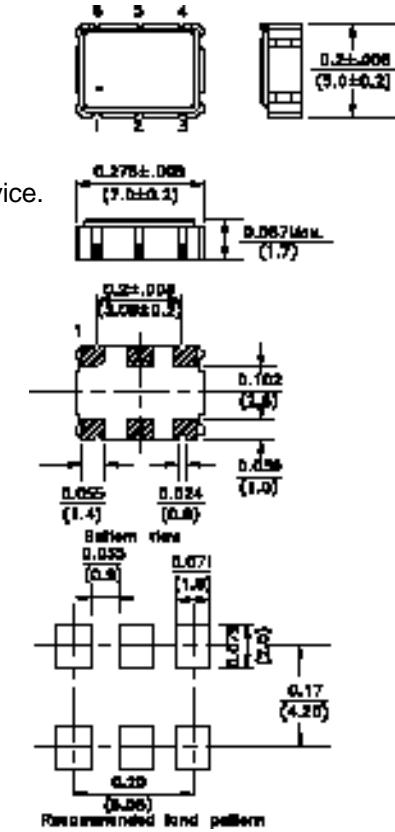
Marking, see appendix G. Tape and Reel, see appendix H.(1,000 pcs.reel).

Application notes, see appendix A. Recommended handling, see appendix F.

ORDERING OPTIONS

AS X V- Frequency - Temperature stability - Duty Cycle - Pulling - Packaging

L or V	-S for 45 / 55% @ 1/2 V _{dd}	-T Tape and Reel
XX.XXXXX MHz		
N151 for ± 150ppm min. @ V _c = 0V to 5Vdc* N102 for ± 100ppm min. @ V _c = 0V to 3.0Vdc* N152 for ± 150ppm min. @ V _c = 0V to 3.0Vdc*		



Dimensions: Inches (mm)

PIN NO.	FUNCTION
1	Voltage Control V _c
2	Tristate E/D
3	GND / Case
4	Output
5	N / C **
6	V _{dd}

** pin 5 E/D
(ASLV1 or ASVV1)

Operating Temperature	Frequency stability (± ppm)					
	Range	code	05	10	15	20
0°C-50°C	I			0	0	0
0°C-60°C	B			0	0	0
-10°C-60°C	D			0	0	0
0°C-70°C	C				0	0
-10°C-70°C	F				0	0
-20°C-70°C	E					0
-40°C-85°C	L					0

0 = available

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TTL / CMOS • FULL-SIZE DIP • 5Vdc or 3.3Vdc

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS ACVX1220 and ACVX1220L



20.2 x 12.6 x 8.0 mm

FEATURES:

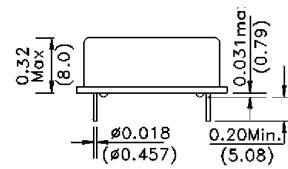
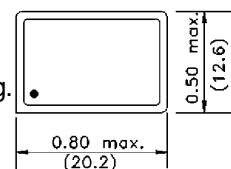
- 14-Pin DIP 5Vdc or 3.3Vdc.
- Large frequency deviation available.
- Hermetically sealed.
- Tight symmetry (45/55%) available.

APPLICATIONS:

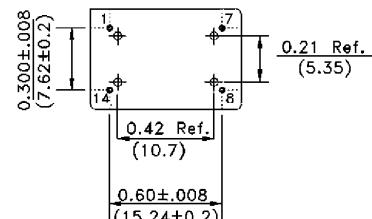
- Phase locked loops (PLLs).
- Clock recovery.
- Synthesizers.
- Reference signal tracking.

STANDARD SPECIFICATIONS

PARAMETERS	ACVX 1220	ACVX 1220 L
Frequency Range (F ₀)	1MHz - 160MHz	1MHz - 120MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- Temp.	±30ppm max. (See Options)	
-vs- Aging	±5ppm / year max.	
-vs- Vdd	±5ppm max.	
Supply Voltage (V _{dd})	5Vdc ±5%	3.3Vdc ±5%
Input Current (I _{dd})	20 mA max. for 1.0MHZ ≤ F < 20MHz 30 mA max. for 20MHZ ≤ F < 40MHz 40 mA max. for 40MHZ ≤ F < 60MHz 50 mA max. for 60MHZ ≤ F < 100MHz 70 mA max. for 100MHZ ≤ F ≤ 160MHz	15mA max. 25mA max. 35mA max. 45mA max. 65mA max.
Duty Cycle or Symmetry	40 / 60% max. @ 1/2V _{dd} (See Options)	
Rise and Fall Times (T _R / T _F)	10ns max. for F ≤ 24MHz 5ns max. F > 24MHz	10ns max.
Output Load	TTL / CMOS (15pF or 10TTL gate)	
Output Voltage (V _{OH})	0.9 *V _{dd} min.	
(V _{OL})	0.4Vdc max.	
Transfer Function	Positive	
Voltage Control (V _c)	0.5Vdc to 4.5V	0.3Vdc to 3Vdc
Center Voltage	2.5Vdc ±0.5V	1.5Vdc ±0.25V
Frequency Deviation	±100ppm min. (See Options)	
Linearity	±10% max.	
Start-up Time (T _{osc})	10ms max.	
Period jitter: Absolute	±100ps max. ≤ 60MHz ; ±200ps max. > 60MHz	
Period jitter: One sigma	±25ps max. ≤ 60MHz ; ±50ps max. > 60MHz	



Dimensions: Inches (mm)



PIN No.	FUNCTION
1	Voltage Control V _c
7	GND / Case
8	Output
14	V _{dd}

OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-70
100	-100
1 kHz	-125
10 kHz	-150
100 kHz	-150

TYPICAL PHASE NOISE

Please call us for higher frequencies, other pulling specs., control voltage range or linearity. Test circuit, waveforms, see appendix B. Environmental and mechanical specifications, see appendix C. Group 1. Marking, see appendix G. Value added, see appendix D. Recommended handling, see appendix F. Application notes, see appendix A.

**ACVX1220 only

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ORDERING OPTIONS

ACVX1220X - Frequency - Temperature - Stability - Duty Cycle - Pulling - Value Added

Blank or L	XX.XXXXX MHz
-I for -0°C to +50°C	-Y for ± 10ppm max.
-D for -10°C to +60°C	-J for ± 20ppm max.
-E for -20°C to +70°C	-R for ± 25ppm max.
-F for -30°C to +70°C	-K for ± 30ppm max.
-N for -30°C to +85°C	-H for ± 35ppm max.
-L for -40°C to +85°C	-C for ± 50ppm max.

-N15 ± 150ppm min.
-N20 ± 200ppm min.
-N25 ± 250ppm min.**
-N30 ± 300ppm min.**
-S for 45/55% @ 1/2V _{dd}
-S1 for 45/55% @ 1.4Vdc

-G Gull Wing.
-GHT Gull Wing Reflow capable.
-QXX (Trimmed Leads)
-TY Tray packing

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20.2 x 12.6 x 5.08 mm

TTL / CMOS • FULL-SIZE DIP • 5Vdc or 3.3Vdc
VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS
ACVX1222 and ACVX1222L

FEATURES:

- 14-Pin DIP 5 Vdc or 3.3Vdc ; 5.08mm height.
- Tight symmetry (45/55%) available.
- Large frequency deviation available.
- Good linearity (10%).

APPLICATIONS:

- Phase locked loops (PLLs).
- Reference signal tracking.
- Clock recovery.
- Synthesizers.

STANDARD SPECIFICATIONS

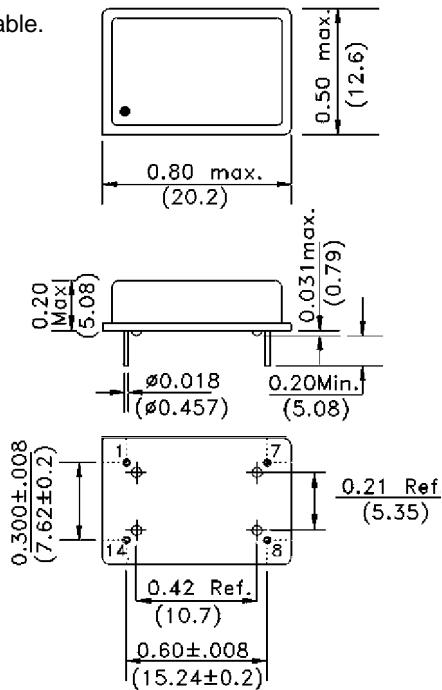
PARAMETERS	ACVX 1222	ACVX 1222 L
Frequency Range (F ₀)	1MHz - 200MHz	
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- Temp.	±100ppm max. (See Options)	
-vs- Aging	±5ppm / year max.	
-vs- Vdd	±5ppm max.	
Supply Voltage (V _{dd})	5Vdc ±5%	3.3Vdc ±5%
	25 mA max. for F ≤ 26 MHz	60 mA max. for F ≤ 70 MHz
Input Current (I _{dd})	30 mA max. for F ≤ 45 MHz	90 mA max. for F ≤ 200 MHz
Duty Cycle or Symmetry	40 / 60% max. @ 1/2V _{dd} (See Options)	
Rise and Fall Times (T _R / T _F)	10ns max. for F ≤ 24MHz 5ns max. F > 24MHz	10ns
Output Load	TTL / CMOS (15 pF or 10 TTL gate)	
Output Voltage (V _{OH})	0.9 *V _{dd} min.	
(V _{OL})	0.4V _{dc} max.	
Transfer Function	Positive	
Voltage Control (V _c)	0.5Vdc to 4.5Vdc	0.3Vdc to 3Vdc
Center Voltage	2.5Vdc ±0.5Vdc	1.5Vdc ±0.25V
Frequency Deviation	±100ppm min. (See Options)	
Linearity	±10% max.	
Start-up Time (T _{osc})	10ms max.	
Input impedance	50K Ω min.	
Period jitter: Absolute	±100ps max. < 60MHz ; ±200ps max. > 60MHz	
Period jitter: One sigma	±25ps max. < 60MHz ; ±50ps max. > 60MHz	

Please call us for higher frequencies, other pulling specs., control voltage range or linearity.

Test circuit, waveforms, see appendix B. Value added, see appendix D. Marking, see appendix G.

Environmental and mechanical specifications, see appendix C. Group 1.

Application notes, see appendix A. Recommended handling, see appendix F.



Dimensions: Inches (mm)

PIN No.	FUNCTION
1	Voltage Control V _c
7	GND / Case
8	Output
14	V _{dd}

OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-70
100	-100
1 kHz	-125
10 kHz	-150
100 kHz	-150

TYPICAL PHASE NOISE**ORDERING OPTIONS****ACVX1222X - Frequency - Temperature - Stability - Duty Cycle - Pulling - Value Added - Packaging**

Blank or L XX.XXXXX MHz

- I for -0°C to +50°C
- D for -10°C to +60°C
- E for -20°C to +70°C
- F for -30°C to +70°C
- N for -30°C to +85°C
- L for -40°C to +85°C

- Y for ± 10ppm max.*
- J for ± 20ppm max.
- R for ± 25ppm max.
- K for ± 30ppm max.
- H for ± 35ppm max.
- C for ± 50ppm max.

- N15 ± 150 ppm min.
- N20 ± 200 ppm min.
- N25 ± 250 ppm min.**
- N30 ± 300 ppm min.**

- S for 45 / 55% @ 1/2 V_{dd}
- S1 for 45 / 55% @ 1.4 V_{dc}

- TY for Tray packing

- G Gull Wing
- QXX (Trimmed Leads)

** ACVX1222 only

* Please contact us for availability.

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TTL / CMOS • HALF-SIZE DIP • 5Vdc or 3.3Vdc

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS AHVX1025 and AHVX1025L



FEATURES:

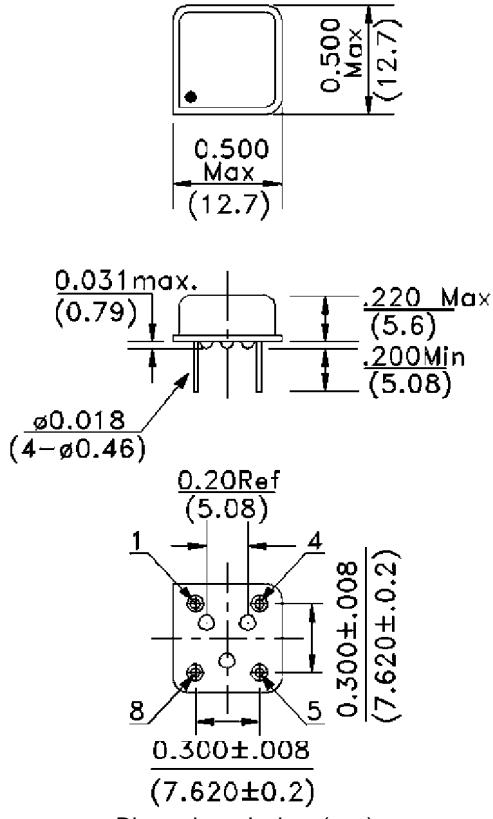
- 8-Pin DIP metal package.
- Tight stability and wide pull range.
- Tight symmetry.
- 5Vdc or 3.3Vdc.

APPLICATIONS:

- Phase locked loops (PLLs)
- Reference signal tracking.
- Clock recovery.
- Set-top box.
- Synthesizers.
- Digital transmission.

STANDARD SPECIFICATIONS

PARAMETERS	AHVX 1025	AHVX 1025L
Frequency Range (F _o)	1.0MHz - 200MHz	
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)	
Storage Temperature (T _{STO})	-55°C to +125°C	
Frequency Stability (ΔF/F _o)	±50ppm max	
Supply Voltage (V _{dd})	5Vdc ±5%	3.3Vdc ±5%
Input Current (I _{dd})	20mA max. for F ≤ 30MHz 35mA max. for F ≤ 65MHz 45mA max. for F ≤ 125MHz 70mA max. for F ≤ 200MHz	
Duty Cycle or Symmetry	45/55% max. @1/2Vdd	
Rise and Fall Times (T _R / T _F)	6ns max.	
Output Load	15pF or 2TTL	
Output Voltage (V _{OH})	0.9 *V _{dd} min.	
(V _{OL})	0.4Vdc max.	
Transfer Function	Positive	
Voltage Control (V _c)	2.5Vdc ±2.0Vdc	1.65Vdc ±1.35V
Frequency Deviation	±100ppm min. (See Options)	
Linearity	±10% max.	
Input impedance	50K Ω min.	
Period jitter: Absolute	±100ps max. ≤ 60MHz ; ±200ps max. >60MHz	
Period jitter: One sigma	±25ps max. ≤ 60MHz ; ±50ps max. >60MHz	



PIN NO.	FUNCTION
1	Voltage Control V _c
4	GND / Case
5	Output
8	V _{dd}

Test circuit, waveforms, see appendix B.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Value added, see appendix D.

Application notes, see appendix A. Reflow profile, see appendix E.

Packaging, see appendix H. Recommended handling, see appendix F.

ORDERING OPTIONS

AHVX1025 X - Frequency - Temperature - Overall Frequency Stability - Pulling - Value Added - Packaging

Blank or L			-N15 ± 150 ppm min.	-TY Tray packing -T Tape and reel (Gull Wing type only)
XX.XXXXX MHz			-Y for ± 10ppm max.* -J for ± 20ppm max. -R for ± 25ppm max. -K for ± 30ppm max. -H for ± 35ppm max.	-G Gull Wing -G2 Gull Wing -GHT Gull Wing, Reflow capable -QXX (Trimmed leads)

* Please contact us for availability.

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20.2 x 12.6 x 5.08 mm

5Vdc • SINE OUTPUT • FULL-SIZE DIP

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS

ACVX1240

FEATURES:

- Sine wave output 0dBm min. into 50Ω.
- Extended temperature available.
- Reduced EMI.
- Wide pulling.

APPLICATIONS:

- Phase locked loops (PLL) circuit.
- EMI reductions meet FCC requirements.
- Synthesizers.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	8.0MHz - 52.0MHz
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-55°C to +125°C
Frequency Stability (ΔF/F ₀)	±50ppm max (See Options)
Supply Voltage (V _{dd})	5Vdc ±5%
Input Current (I _{dd})	35mA max.
Output Load	50Ω
Output Voltage	0dBm min.
Transfer Function	Positive
Voltage Control (V _c)	2.5Vdc ±2.0Vdc
Frequency Deviation	±100ppm min. (See Options)
Linearity	±10% max.
Harmonics	-30dBc min.
Input Impedance	50k Ω min.
Start-up Time (T _{osc})	10ms max.

Please Inquire with factory for higher frequencies, other pulling specs., Control voltage range or linearity.

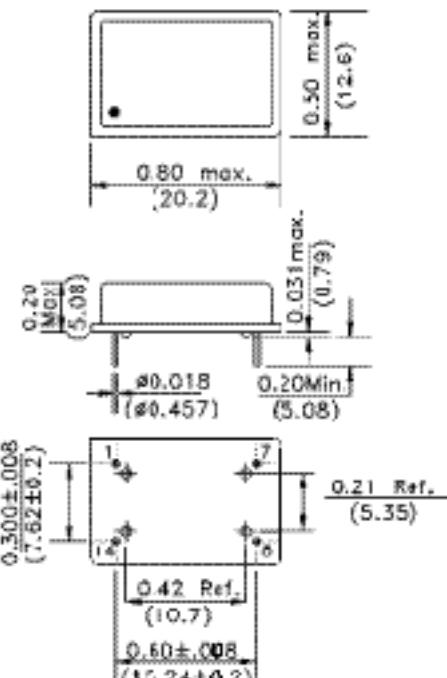
Test circuit, waveforms, see appendix B.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G. Reflow profile, see appendix E.

Value added, see appendix D. Recommended handling, see appendix F.

Application notes, see appendix A.



Dimensions: Inches (mm)

PIN NO.	FUNCTION
1	Voltage Control V _c
7	GND / Case
8	Output
14	V _{cc}

ORDERING OPTIONS

ACVX1240 - Frequency - Temperature - Overall Frequency Stability - Pulling - Value Added - Packaging

XX.XXXXX MHz
 -D for -10°C to +60°C
 -E for -20°C to +70°C
 -F for -30°C to +70°C
 -N for -30°C to +85°C
 -L for -40°C to +85°C

-J for ± 20ppm max.
 -R for ± 25ppm max.
 -K for ± 30ppm max.
 -H for ± 35ppm max.

-N15 ± 150ppm min.

-TY for Tray packing

-G Gull Wing
 -QXX (Trimmed Leads)



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HIGH FREQUENCY • INVERTED MESA • TTL / CMOS • FULL-SIZE DIP • 5VDC

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS

ACVX1224



20.2 x 12.6 x 7.2 mm

FEATURES:

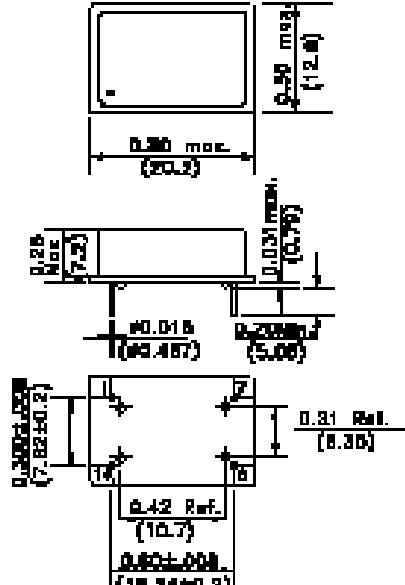
- 14-Pin DIP 5Vdc.
- Tight symmetry (45/55%) available.
- High stability.
- Large frequency deviation available.
- Inverted mesa crystal.
- Low noise.

APPLICATIONS:

- Phase locked loops (PLLs).
- Reference signal tracking.
- Gigabit ethernet, XDM.
- Synthesizers.

STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	65MHz - 300MHz*
Operating Temperature (T _{OPR})	0°C to +70°C (See Options)
Storage Temperature (T _{STO})	-40°C to +85°C
Overall Frequency Stability	±25ppm max. (See Options)
Supply Voltage (V _{dd})	5Vdc ±5%
Input Current (I _{dd})	60mA max.
Duty Cycle or Symmetry	40 / 60% max. @ 1/2V _{dd} (See Options)
Rise and Fall Times (T _R / T _F)	6ns max.
Output Load	TTL / CMOS (50pF or 10TTL gate)
Output Voltage (V _{OH})	0.9 *V _{dd} min.
(V _{OL})	0.4Vdc max.
Transfer Function	Positive
Voltage Control (V _c)	0.5Vdc to 4.5Vdc
Center Voltage	2.5Vdc ±0.5Vdc
Frequency Deviation	±100ppm min. (See Options)
Linearity	±10% max.
Start-up Time (T _{osc})	10ms max.



Dimensions: Inches (mm)

* Under development 160MHz to 300MHz, please call for availability.

Please call us for higher frequencies, other pulling specs., control voltage range or linearity.

Environmental and mechanical specifications, see appendix C. Group 1.

Marking, see appendix G.

Test circuits and waveform, see appendix B.

Value added, see appendix D.

Recommended handling, see appendix F.

Application notes, see appendix A.

TYPICAL PHASE NOISE

OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-70
100	-100
1kHz	-125
10kHz	-150
100kHz	-160

PIN No.	FUNCTION
1	Voltage Control V _c
7	GND / Case
8	Output
14	V _{dd}

ORDERING OPTIONS

ACVX1224 - Frequency - Temperature - Stability - Duty Cycle - Pulling - Value Added - Packaging

XX.XXXXX MHz

-D for -10°C to +60°C
-E for -20°C to +70°C
-F for -30°C to +70°C
-N for -30°C to +85°C
-L for -40°C to +85°C

-N15 ± 150ppm min.

-TY for Tray packing

-S for 45 / 55% @ 1/2V_{dd}

-J for ±20ppm max.

-G Gull Wing

-QXX (Trimmed Leads)

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11.4 x 9.6 x 4.0 mm

5.0Vdc OR 3.3Vdc SURFACE MOUNT CRYSTAL OSCILLATORS VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED ASTX-01 and ASVTX-01 Series

FEATURES:

- Compact and low in height.
- Suitable for high-density SMT.
- SMD makes reflow soldering possible.

- Low current consumption.
- Vc function corresponds to PLL circuits.
- Low voltage supply on option "-A".

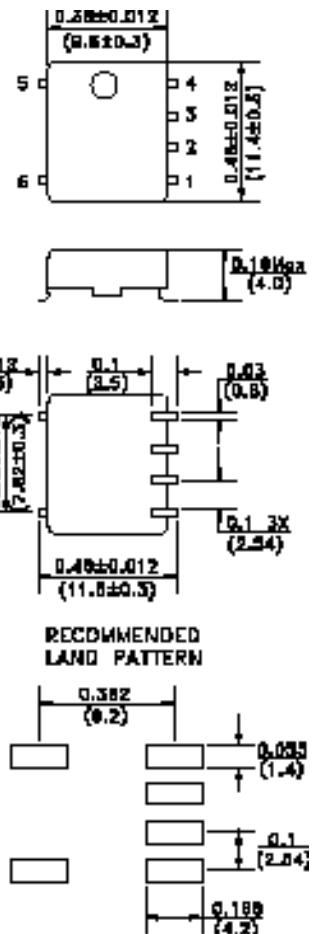
- HCMOS/TTL or sine output.

APPLICATIONS:

- Cellular and cordless phones.
- Standard OSC for exact equipment.
- Portable radio equipment.
- Car telephones.

STANDARD SPECIFICATIONS

Parameters	ASTX-01/ 01A ASVTX-01/ 01A	ASTX-01H (01HA) ASVTX-01H (01HA)
Frequency Range (F ₀)	10MHz ~ 27.0MHz	1.25MHz ~ 27.0MHz
Operating Temperature (T _{OPR})	-30°C to +75°C (See table)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- 25°C -vs- Temperature -vs- Aging -vs- Supply Voltage (±5%) -vs- load (±10%)	±0.5ppm max. ±2.5ppm max. (See table) ±1.0ppm max./ year. ±0.3ppm max. ±0.3ppm max.	
Supply Voltage (V _{cc})	5Vdc ±5% or 3.3Vdc ±5% (-A)	
Input Current (I _{cc})	2mA max. (5V) 1.5mA max. (3.3V)	20mA max. (5V) 15mA max. (3.3V)
Output Load	10k Ω // 10pF	10TTL or 15pF
Output Voltage	1.0Vpp min. (5V) 0.8Vpp min. (3.3V)	VOH 0.9 *V _{cc} min. VOL = 0.1*V _{cc} max.
Transfer Function (V Series)	Positive	
Voltage Control (V _c)	2.5Vdc ±2V (for 5V) or 1.5Vdc ±1V (for 3.3V)	
Frequency Pulling (V Series)	±10ppm min	
Frequency Adjustment (Internal Trimmer)	±3ppm min.	



ORDERING OPTIONS

ASXTX-01XX - Frequency - Temperature & Frequency Stability - Packaging - T Tape and Reel

Blank or V XX.XXXXX MHz
Blank or H Blank or A

Test circuit, waveforms, see appendix H.
Environmental and mechanical specifications, see appendix C. Group 4.
Marking, see appendix G.
Tape and Reel, see appendix H.
(1,000 pcs./reel) Recommended handling, see appendix F. Application notes, see appendix A. Please call us for higher frequencies, other pulling specs. or control voltage range.

Operating Temperature	Frequency stability (± ppm) (0) Denotes availability								
	Range	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
0°C~50°C	I	0	0	0	0	0	0	0	0
-10°C~60°C	D	0	0	0	0	0	0	0	0
-10°C~70°C	C		0	0	0	0	0	0	0
-20°C~70°C	E		0	0	0	0	0	0	0
-30°C~60°C	H			0	0	0	0	0	0
-30°C~70°C	F			0	0	0	0	0	0
-30°C~75°C	N			STD	0	0	0	0	0
-40°C~80°C	M				0	0	0	0	0
-40°C~85°C	L				0	0	0	0	0

Dimensions:
Inches (mm)

PIN #	FUNCTION
1	Output
2	GND
3	NC or V _c *
4	V _{cc}
5, 6	GND / Case

* V Series Only

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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5Vdc OR 3.3Vdc • HCMOS/TTL, CLIPPED SINE • SURFACE-MOUNT

VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED ASVTX-02 Series



18.5 x 12 x 5.0 mm

FEATURES:

- SMD makes reflow soldering possible.
- Compact and low in height.
- Tight stability available.
- Low current consumption.
- Control voltage function.
- 5.0V or 3.3Vdc supply.

APPLICATIONS:

- Cellular and cordless phones.
- Faximile and computer control.
- Reference clock.
- Communication equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ASVTX-02H (A)	ASVTX-02 (A)
Frequency Range (F ₀)	1MHz - 35MHz	9.6MHz - 45MHz
Operating Temperature (T _{OPR})	-10°C to +60°C (See Options / Table 1)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- 25°C -vs- Temperature -vs- Load (± 10%) -vs- Aging -vs- Supply Voltage (±5%)	±1.0ppm max. for F ≤ 30MHz ; ±2.0ppm max. for F > 30MHz ±2.5ppm max. (See Options / Table 1) ±0.2ppm max. ±1ppm per year max. ±0.5ppm max.	
Supply Voltage (V _{cc})	5Vdc ±5% or 3.3Vdc ±5% (A Series)	
Input Current (I _{cc})	15mA max. for F ≤ 20MHz 25mA max. for F > 20MHz	2.0mA max. for F ≤ 20MHz 3.0mA max. for F ≤ 30MHz 4.0mA max. for F > 30MHz
Duty Cycle or Symmetry	40/60% max.	N/A
Rise and Fall Times (T _R / T _F)	10ns max.	N/A
Output Load	15pF or 10TTL	10k Ω // 10pF
Output Voltage (V _{OH}) (V _{OL})	0.9 *Vdd min. 0.4V _{dc} max.	1Vpp min. Clipped Sine 0.7Vpp min. (A Series)
Frequency Adjustment (Internal Trimmer)		±3ppm min.
V _c and Freq. Pulling	±10ppm min. 0.5V to 4.5V or 0.15V to 3.15V (A)	

Test circuit, waveforms, see appendix B. Recommended handling, see appendix F.

Environmental and mechanical specifications, see appendix C. Group 4.

Marking, see appendix G. Application notes, see appendix A.

Tape and reel, see appendix H.

ORDERING OPTIONS

ASVTX-02XX - Frequency - Temperature & Frequency Stability - Packaging

Blank or H	Blank or A	XX.XXXXX MHz	-T Tape and Reel
------------	------------	--------------	------------------

* DEPENDING ON FREQUENCY

PIN #	FUNCTION
1	V _c
7	GND / Case
8	Output
14	V _{cc}

TABLE 1

TEMPERATURE RANGE °C	±0.5ppm max.	±1ppm max.	±1.5ppm max.	±2ppm max.	±2.5ppm max.	±3ppm max.	±5ppm max.
0°C to +50°C	C 05	C 10	C 15	C 20	C 25	C 30	C 50
-10°C to +60°C		D 10	D 15	D 20	Standard	D 30	D 50
-20°C to +70°C				E 20	E 25	E 30	E 50
-30°C to +75°C				F 20 *	F 25 *	F 30 *	F 50 *
-40°C to +85°C						G 30 *	G 50 *

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18.3 x 11.7 x 4.7 mm

**5Vdc SURFACE MOUNT CRYSTAL OSCILLATORS
VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED
ASTX-03 and ASVTX-03 Series**

FEATURES:

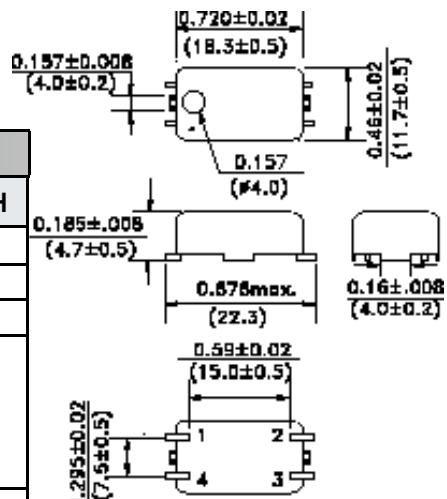
- Clipped sine or HCMOS/TTL output.
 - Suitable for high-density SMT.
 - SMD makes reflow soldering possible.
 - Low current consumption.
 - Vc function corresponds to PLL circuits.
 - Compact and low in height.

APPLICATIONS:

- Cellular and cordless phones.
 - Standard OSC for exact equipment.
 - Mobile communication equipment.
 - Portable radio equipment.

STANDARD SPECIFICATIONS

PARAMETERS		ASTX-03 & ASVTX-03	ASTX-03H & ASVTX-03H
Frequency Range	(F ₀)	9.600MHz - 30.000 MHz	2.0MHz - 25.00MHz
Operating Temperature	(T _{OPR})	-30°C to +75°C (See Options)	
Storage Temperature	(T _{STO})	-40°C to +85°C	
Frequency Stability -vs- 2.5°C	(ΔF/ F ₀)	±0.5ppm max.	
-vs- Temperature		±2.5ppm max. (See Options)	
-vs- Aging		±1ppm per year max.	
-vs- Supply Voltage		±0.2ppm max.	
Supply Voltage	(V _{cc})	5Vdc ±5%	
Input Current	(I _{cc})	2.0mA max. for F ≤ 24MHz 4.0mA max. for F > 24MHz	20mA max.
Output Load		10k Ω // 10pF	2TTL or 15pF
Output Voltage		1Vpp min. Clipped Sine	V _{OH} = 0.9 x VDD min. V _{OL} = 0.5VDC max.
Transfer Function		Positive	
Voltage Control (V Series)	(V _c)	2.5V ±2Vdc	
Frequency Pulling (V Series)		±5ppm min, ±20ppm max	



Dimensions: inches (mm)

PIN #	FUNCTION
1	NC or Vc *
2	GND / Case
3	Output
4	Vcc

* V series only

Test circuit, waveforms, see appendix B.

Environmental and mechanical specifications see appendix C, Group 4

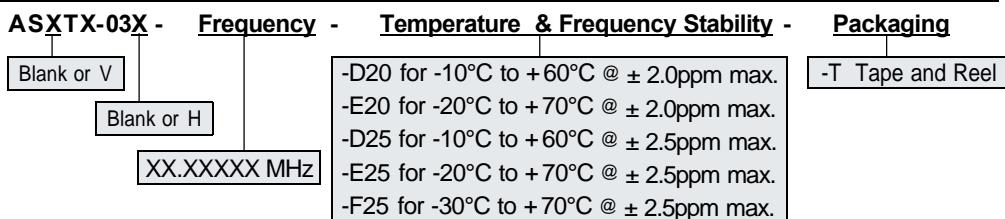
Marking see appendix G. Tape and Reel see appendix H (1 000 pcs /reel)

Reflow profile see appendix E Recommended handling see appendix E

Renew profile, see appendix E. Re-
Application notes, see appendix A

Application notes, see appendix A.
Please call us for other frequencies

ORDERING OPTIONS



NOTE: Left blank if standard • All specifications and markings subject to change without notice

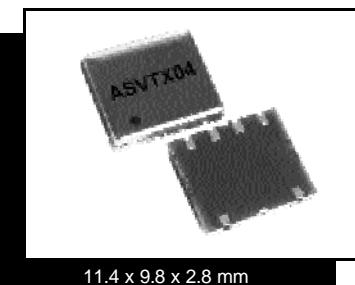
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5Vdc or 3.3Vdc • LEADLESS • SURFACE MOUNT

VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED ASVTX-04 and ASVTX-05 Series



11.4 x 9.8 x 2.8 mm

FEATURES:

- Vc function corresponds to PLL circuits.
- Suitable for high-density SMT.
- SMD makes reflow soldering possible.
- Leadless type provides excellent coplanarity.
- Low voltage supply option "A".
- Low current consumption.
- Excellent phase noise.

APPLICATIONS:

- Cellular and cordless phones.
- Mobile communication equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ASTX -04 & -05 ASVTX -04 & -05	ASXT-04A & -05A ASVTX-04A & -05A
Frequency Range (F ₀)	10.000MHz - 25.000MHz	
Operating Temperature (T _{OPR})	-25°C to +75°C (See Options)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability (ΔF/ F ₀)		
-vs- 25°C	±0.5ppm max.	
-vs- Temperature	±2.5ppm max. (See Options)	
-vs- Aging	±1ppm per year max.	
-vs- Supply Voltage (±5%)	±0.3ppm max.	
-vs- Load (±10%)	±0.2ppm max.	
Supply Voltage (V _{cc})	5Vdc ±5%	3Vdc ±5%
Input Current (I _{cc})	2mA max	1.5mA max.
Output Load	10k Ω // 10pF	
Output Voltage	1Vpp min. Clipped Sine	0.8Vpp min Clipped Sine
Transfer Function	Positive	
Voltage Control (V _c)	2.5V ±2Vdc	1.5V ±1Vdc
Frequency Pulling	±15ppm min.(See options)	±5ppm min.(See options)
Frequency Adjust (Option IR) (Internal trimmer)	±3.0ppm min.	

Please Inquire with factory for higher frequencies.

Test circuit, waveforms, see appendix B.

Environmental and mechanical specifications, see appendix C.

Group 4. Recommended handling, see appendix F.

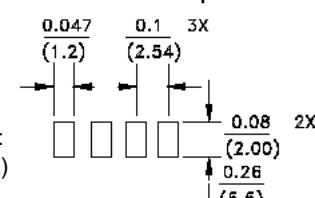
Tape & Reel, see appendix H.(1,000 pcs./reel).

Marking, see appendix G.

Application notes, see appendix A.Reflow profile, see appendix E.

PIN NO.	ASTX -04 ASVTX-04	ASTX -05 ASVTX-05
1	Output	Vc or NC
2	GND	GND/ Case
3	Vc or NC	Output
4	Vcc	Vcc
5, 6	GND / Case	N/A

Recommended land pattern

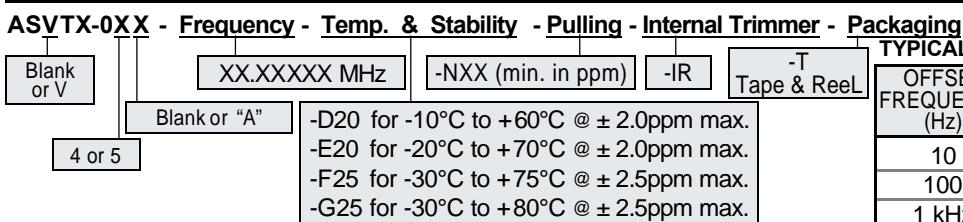


Dimensions:
Inches (mm)

TYPICAL PHASE NOISE	
OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-90
100	-120
1 kHz	-135

Ignore middle
two pads for
ASVTX-05

ORDERING OPTIONS



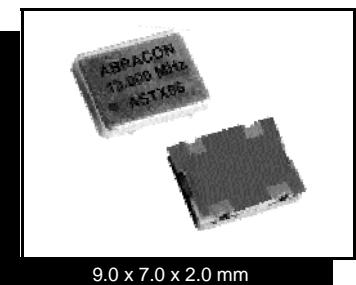
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9.0 x 7.0 x 2.0 mm

3Vdc • MINIATURE LEADLESS • SURFACE MOUNT • CRYSTAL OSCILLATORS VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED ASTX-06, ASVTX-06, ASVTX-07

FEATURES:

- Low profile,(2.0mm) suitable for high density SMT.
- Leadless type provides excellent coplanarity.
- Suitable for reflow soldering.
- Excellent phase noise.

APPLICATIONS:

- Mobile communication equipment.
- Cellular and cordless phones.
- Cellular base station.
- GPS navigation system.

STANDARD SPECIFICATIONS

PARAMETERS	ASTX-06	ASVTX-06	ASVTX-07
Frequency Range (F _o)	12.6MHz - 19.8MHz		
Operating Temperature (T _{OPR})	-20°C to +75°C		
Storage Temperature (T _{STO})	-40°C to +85°C		
Frequency Stability ($\Delta F / F_0$)			
-vs- Temperature	$\pm 2.5\text{ppm}$ max. (See Table 1)		
-vs- Aging	$\pm 1\text{ppm}$ per year max.		
-vs- Supply Voltage	$\pm 0.3\text{ppm}$ max.		
Supply Voltage (V _{cc})	3Vdc $\pm 5\%$		
Input Current (I _{cc})	2.0mA max.		
Output Load	10k Ω // 10pF		
Output Voltage	0.8Vpp min. Clipped Sine		
Transfer Function (V Series)	Positive		
Voltage Control (V Series) (V _c)	1.5V $\pm 1\text{Vdc}$		
Frequency Pulling (V Series)	N/A	$\pm 9\text{ppm} \sim \pm 15\text{ppm}$	$\pm 5\text{ppm} \sim \pm 15\text{ppm}$

Test circuit, waveforms, see appendix B.

Environmental & mechanical specifications, see appendix C. Group 4.

Tape and Reel, see appendix H.(1,000 pcs./reel) Marking, see appendix G.

Recommended handling, see appendix F.

Application notes, see appendix A. Reflow profile, see appendix E.

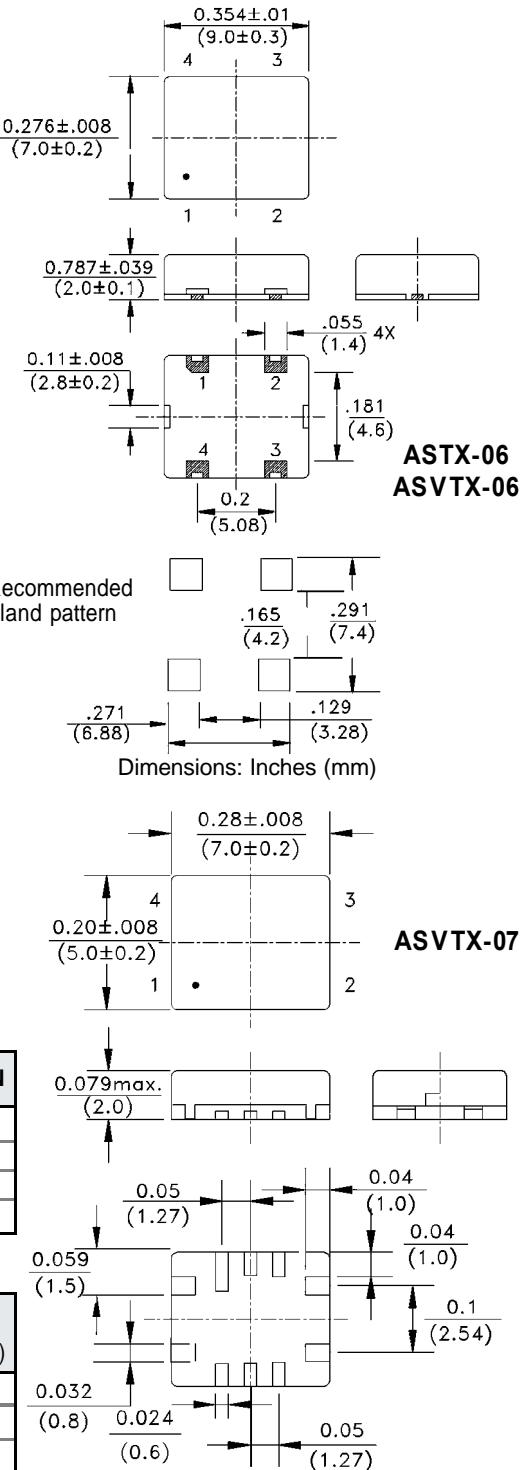
ORDERING OPTIONS

ASVTX-0X - Frequency - Packaging
 Blank or V XX.XXXXX MHz -T (Tape & Reel)
 "6" or "7"

PIN NO.	FUNCTION
1	NC or V _c
2	GND
3	Output
4	V _{dd}

TYPICAL PHASE NOISE

OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-90
100	-120
1kHz	-135



3Vdc • SURFACE MOUNT CRYSTAL OSCILLATORS

VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED

ASVTX-08



7.0 x 5.0 x 1.8 mm

FEATURES:

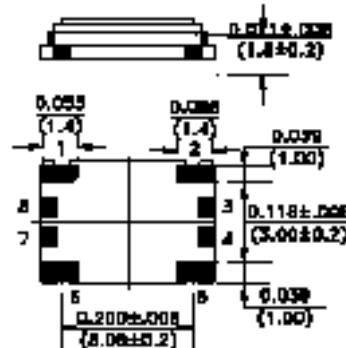
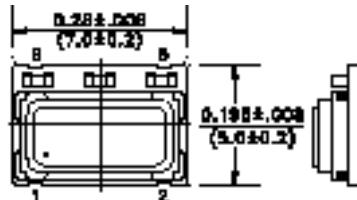
- Compact and low in height.
- Suitable for high-density SMT.
- SMD makes reflow soldering possible.
- Low current consumption.
- Vc function corresponds to PLL circuits.

APPLICATIONS:

- Cellular and cordless phones.
- Standard OSC for exact equipment.
- Mobile communication equipment.
- Portable radio equipment.

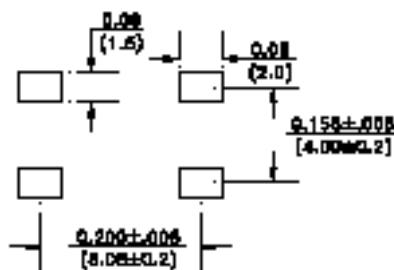
STANDARD SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Frequency Range (F ₀)	12.8MHz - 19.680MHz**
Operating Temperature (T _{OPR})	-30°C to +80°C (See Options)
Storage Temperature (T _{STO})	-40°C to +85°C
Frequency Stability (ΔF / F ₀)	
-vs- Temperature	±2.5ppm max.
-vs- Aging	±1ppm per year max.
-vs- Supply Voltage	±0.2ppm max.
-vs- Load	±0.3ppm max.
Supply Voltage (V _{cc})	3.0Vdc ±5%
Input Current (I _{cc})	2mA max.
Output Load	10k Ω // 10pF
Output Voltage	0.8Vpp min. Clipped Sine
Transfer Function	Positive
Voltage Control (V Series) (V _c)	0.5V to 2.5Vdc
Frequency Pulling (V Series)	±4.5ppm min, ±7.5ppm max



Bottom View

Recommended Land Pattern



Dimensions: Inches (mm)

PIN #	FUNCTION
1	V _c
2	GND / Case
5	Output
6	V _{cc}
3, 4	NC
7, 8	

Test circuit, waveforms, please see appendix B.

Environmental and mechanical specifications see appendix C. Group 4.

Marking, see appendix G. Reflow profile, see appendix E.

Tape and Reel, see appendix H.(1,000 pcs./reel)

Application notes, see appendix A. Recommended handling, see appendix F.

** Please call us for other frequencies, pulling specs. or control voltage range.

ORDERING OPTIONS

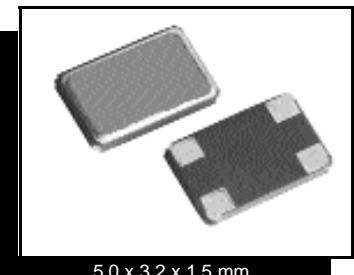
ASVTX-08 - Frequency - Packaging
XX.XXXXX MHz -T (Tape & Reel)

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5.0 x 3.2 x 1.5 mm

3Vdc • CERAMIC SURFACE MOUNT CRYSTAL OSCILLATORS VOLTAGE-CONTROLLED TEMPERATURE-COMPENSATED ASTX-09 and ASVTX-09 Series

FEATURES:

- Leadless surface mount size 5.0 x 3.2 x 1.5 mm max.
- Compact and low in height.
- Suitable for high-density SMT.
- SMD makes reflow soldering possible.
- Low current consumption.
- Vc Function corresponds to PLL circuits.

APPLICATIONS:

- Cellular and cordless phones.
- GPS and communication equipment.
- Portable radio equipment.
- Mobile communication.

STANDARD SPECIFICATIONS

PARAMETERS	ASTX-09	ASVTX-09
Frequency Range (F ₀)	12.800MHz - 19.680MHz*	
Operating Temperature (T _{OPR})	-30°C to +75°C (See Options)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- 25°C	±0.5ppm max.	
-vs- Temperature	±2.5ppm max.	
-vs- Aging	±1ppm per year max.	
-vs- Supply Voltage	±0.2ppm max. (Vcc ± 5%)	
Supply Voltage (V _{cc})	3.0Vdc ±5% (operating at 2.7V ~ 5V)	
Input Current (I _{cc})	2mA max.	
Output Load	10k Ω // 10pF	
Output Voltage	0.8Vpp min. Clipped Sine	
Transfer Function (V series)	Positive	
Voltage Control (V Series) (V _c)	-	1.5V ±1Vdc
Frequency Pulling (V Series)	-	±8ppm max

Test circuit, waveforms, please see appendix B.

Environmental and mechanical specifications see appendix C. Group 4.

Marking, see appendix G.

Tape and Reel, see appendix H.(1,000 pcs./reel)

Application notes, see appendix A.

Recommended handling, see appendix F.

* Please call us for other frequencies, pulling specs. or control voltage range.

ORDERING OPTIONS

ASXTX-09 - Frequency - Packaging

Blank or V

XX.XXXXX MHz

-T Tape and Reel

5Vdc or 3.3Vdc • TTL / CMOS AND SINE WAVE

TEMPERATURE-COMPENSATED XTAL OSCILLATORS

ACTX 1018 and ACVTX 1018 Series



18.3 x 12 x 8.0 mm

FEATURES:

- Compatible with 14 pin dual in line.
- Compact size.
- Tight stability available.
- Low current consumption.

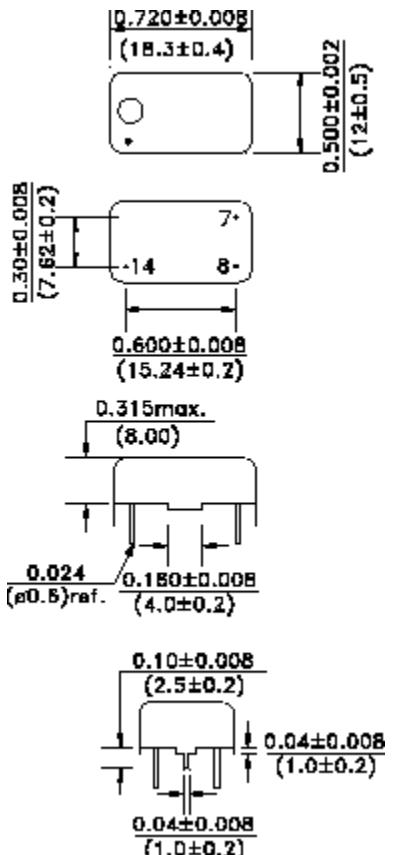
- Control voltage function.
- Low can height option.

APPLICATIONS:

- Cellular and cordless phones.
- Facsimile and computer control.
- Reference clock.
- Communication equipment.

STANDARD SPECIFICATIONS

PARAMETERS	ACTX 1018 (A) ACVTX1018 (A)	ACTX 1018S (A) ACVTX1018S (A)
Frequency Range (F ₀)	1MHz - 35MHz	8MHz - 45MHz
Operating Temperature (T _{OPR})	-10°C to +60°C (See Options / Table 1)	
Storage Temperature (T _{STO})	-40°C to +85°C	
Frequency Stability -vs- 25°C -vs- Temperature -vs- Load (± 10%) -vs- Aging -vs- Supply Voltage (±5%)	±0.5ppm max. ±2.5ppm max. (See Options / Table 1) ±0.2ppm max. ±1ppm per year max. ±0.5ppm max.	
Supply Voltage (V _{dd})	5Vdc ±5% or 3.3Vdc ±5% (A Series)	
Input Current (I _{dd})	20mA max.	2mA max. for F ≤ 35 MHz 4mA max. for F > 35 MHz
Duty Cycle or Symmetry	40/60% max.	N/A
Rise and Fall Times (T _R / T _F)	10ns max.	N/A
Output Load	15pF or 10TTL	10k Ω // 10pF
Output Voltage (V _{OH}) (V _{OL})	0.9 *V _{dd} min. 0.4V _{dc} max.	1Vpp min. Clipped Sine 0.7Vpp min. (A Series)
Frequency Adjustment (Internal Trimmer)		±3ppm min.
V _c and Freq. Pulling (V Series)	0.5V to 4.5V or 0.3V to 3.0V (±5ppm ~ ±20ppm)	



Dimensions: Inches (mm)

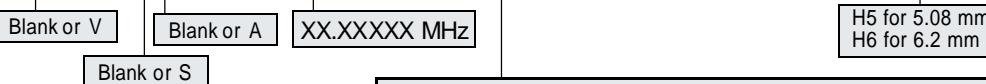
NOTES:

- Open slot may be present on cover for H5 or H6.
- Pin 1 may be present with no connection function.

* DEPENDING ON FREQUENCY

ORDERING OPTIONS

ACTX 1018XX - Frequency - Temperature & Frequency Stability - Max. Can Height



PIN #	FUNCTION
1	V _c or NC
7	GND / Case
8	Output
14	V _{cc}

TABLE 1

TEMPERATURE RANGE °C	±0.5ppm max.	±1ppm max.	±1.5ppm max.	±2ppm max.	±2.5ppm max.	±3ppm max.	±5ppm max.
0°C to +50°C	C 05	C 10	C 15	C 20	C 25	C 30	C 50
-10°C to +60°C		D 10	D 15	D 20	Standard	D 30	D 50
-20°C to +70°C				E 20	E 25	E 30	E 50
-30°C to +75°C				F 20*	F 25*	F 30*	F 50*
-40°C to +85°C						G 30*	G 50*

NOTE: Left blank if standard • All specifications and markings subject to change without notice

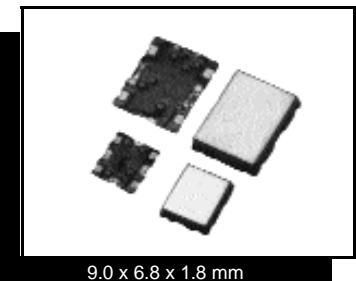
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ABRACON®
CORPORATION



RF FREQUENCY • SURFACE-MOUNT
VOLTAGE-CONTROLLED OSCILLATORS
ACV Series

9.0 x 6.8 x 1.8 mm

FEATURES:

- Surface-mount, Reflow capable.
- Strip-line resonator.
- Excellent C/N, S/N ratio.
- Low operating voltage.
- High accurate frequency tuning.
- High performance and high reliability.

APPLICATIONS:

- Cellular phones.
- Cordless phones.
- Mobile radios.
- Wireless communication.

Package outline drawings located on page 75

CUSTOMIZED VCOs:

Abracon Corporation is ready to meet your custom VCO requirements. The table provided below highlights just a few of our common application specific VCOs. The Abracon Applications Team of skilled engineers can assist you with developing and specifying a high performance customized VCO solution. Please contact Abracon directly or visit our website and send your inquiry via email using our custom VCO ordering guide.

STANDARD SPECIFICATIONS

Abracon Part Number	Freq. (MHz)	Vcc (V)	Vc (V)	Output level (dBm)	Current (mA) max.	C/N (dBc)	Harmonics (dBc)	Freq. Push (MHz)	Freq. Pull (MHz)	Applications	Package Code
ACV795801	2450±65	3.0±0.15	0.4 ~ 2.4	-1.0±4.0	12.0	-75@10k	≥-10	±3	±4	Cordless phones	ACV7958
ACV795802	1635±22	3.0±0.15	0.5 ~ 2.5	≥-3.0	8.8	-111@100k	≥-10	±1	±1	PCS	ACV7958
ACV795803	1750±45	3.0±0.15	0.5 ~ 2.5	≥-3.0	8.8	-111@100k	≥-10	±1	±1	PCS	ACV7958
ACV795804	967±18	3.35±0.15	0.7 ~ 2.7	≥-3.0	6.4	-111@30k	≥-10	±1	±1	CDMA	ACV7958
ACV907001	1576-1658	2.8±0.15	0.5 ~ 2.2	-2±4	10.0	-85@10k	≤-10	±1.5	±4	DCS Rx	ACV9070
Dual VCO	1150-1185	2.8±0.15	0.5 ~ 2.2	-2±4	10.0	-85@10k	≤-10	±1	±3	GSM Rx	
ACV907002	1485-1495	2.9±0.15	0.5 ~ 2.5	0±3	10.0	-100@10k	≤-15	±.6	±2	GPS	ACV9070
Dual VCO	954-980	2.9±0.15	0.5 ~ 2.5	0±3	10.0	-100@10k	≤-10	±.6	±1	CDMA	
ACV907003	1720-1780	2.8±0.15	0.5 ~ 2.5	≥-3.0	10.0	-90@10k	≤-15	±1	±2	PCS	ACV9070
Dual VCO	954-980	2.8±0.15	0.5 ~ 2.5	≥-3.0	10.0	-100@10k	≤-10	±1	±1	CDMA(AMPS)	
ACV866501	1439-1526	2.75±0.15	0.8 ~ 2.3	-1±3	10.0	-113@300k	≤-13	±1.5	±2	DCS Rx	ACV8665
Dual VCO	1279-1367	2.75±0.15	0.8 ~ 2.3	0±3	10.0	-113@300k	≤-13	±1.5	±2	GSM Rx	
ACV625201	1750±35	2.80±0.15	0.5 ~ 2.5	≥-3.0	8.8	-111@100k	≤-15	±1	±1	US-PCS	ACV6252
ACV625202	967±18.0	2.7±0.1	0.7 ~ 2.7	≥-3.0	6.4	-110@10k	≥-15	±1	±1	CDMA	ACV6252
ACV606001	1750±35	3.0±0.15	0.5 ~ 2.5	≥-3.0	8.8	-111@100k	≤-15	±1	±1	US-PCS	ACV6060
ACV606002	967±18.0	3.0±0.15	0.7 ~ 2.7	≥-3.0	6.4	-110@10k	≥-15	±1	±1	CDMA	ACV6060
ACV554801	1750±35	2.8±0.15	0.5 ~ 2.5	≥-3.0	8.8	-111@100k	≤-15	±1	±1	US-PCS	ACV5548
ACV554802	967±18.0	2.8 ~ 3.0	0.5 ~ 2.5	≥-3.0	6.4	-110@100k	≥-15	±1	±1	CDMA	ACV5548

ACV9070

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	GND
5	Output
6	GND
7	S/W
8	GND

ACV8665

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	GND
5	Output
6	GND
7	S/W
8	GND

ACV7958

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	Output
5	GND
6	GND

ACV6252

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	GND
5	Output
6	GND
7	GND
8	GND

ACV6060

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	Output
5	GND
6	GND
7	GND
8	GND

ACV5548

PIN #	FUNCTION
1	Vc
2	GND
3	Vcc
4	GND
5	Output
6	GND
7	GND
8	GND

See Next Page for Dimension outlines.

Dimensions: Inches (mm) Operating temperature -20°C to +70°C

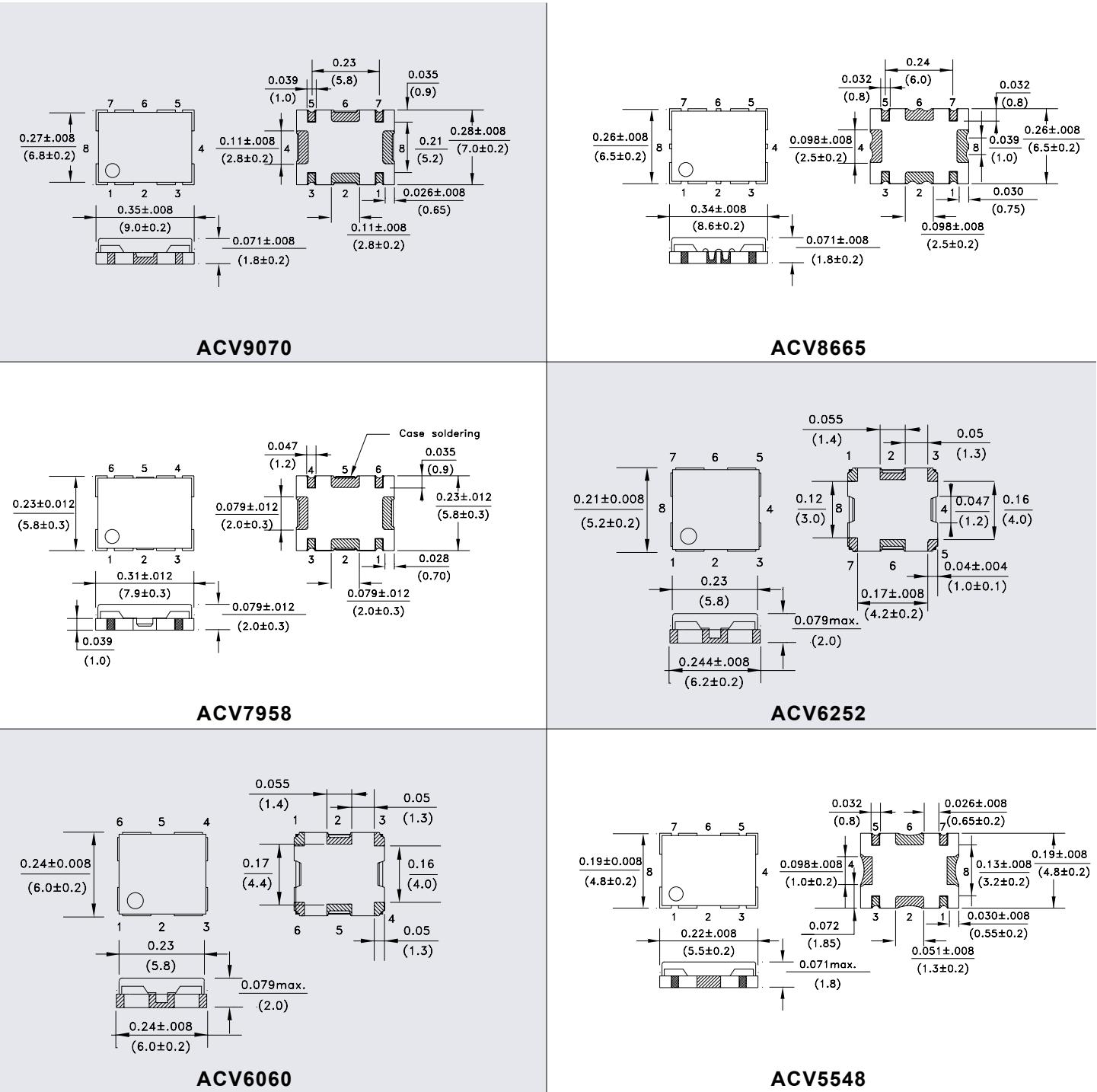
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RF FREQUENCY SURFACE-MOUNT
VOLTAGE-CONTROLLED OSCILLATORS
ACV Series Package Outline



Dimensions: Inches (mm)

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CORPORATION [®]

ORDER FORM

Visit www.abracon.com for online order forms

CUSTOM VOLTAGE-CONTROLLED OSCILLATORS (VCO)

Please specify the following items when ordering Voltage-Controlled Oscillators (VCO)

I. ELECTRICAL CHARACTERISTICS

Center frequency: _____ MHz at Vc = _____ V

Lower frequency: _____ MHz at Vc = _____ V

Upper frequency: _____ MHz at Vc = _____ V

Supply voltage: _____ Vdc ± _____ V

Supply current: _____ mA max.

Output level: _____ dBm min. or _____ ± _____ dBm

Control voltage: _____ V to _____ V

Tuning sensitivity: _____ ± _____ MHz/V

Frequency pushing: ≤ _____ MHz

Frequency pulling: ≤ _____ MHz

Harmonics: ≤ _____ dBc

Non harmonics: ≤ _____ dBc

Switching voltage: ON: ≤ _____ V; OFF: ≥ _____ V

Switching current: ≤ _____ mA

Start-up time: _____ µs max.

Load impedance: _____ Ω

Operating temperature: _____ °C to _____ °C

Frequency stability: ± _____ MHz

II. PACKAGE TYPES

Leaded q Dimensions: _____

SMD q Dimensions: _____

III. APPLICATIONS

Application: _____

EAU: _____ / month _____ / year

Quantity requested for quote: _____

IV. SPECIAL ENVIRONMENTAL CONDITIONS

Storage temperature: _____ °C to _____ °C

Vibration total amplitude: _____ mm

Frequency of vibration: _____ Hz to _____ Hz

Shock: _____

Others: _____



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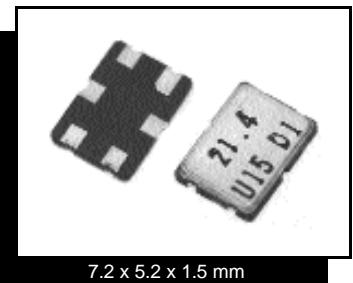
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CERAMIC SURFACE-MOUNT • 21.4MHz and 45MHz FUNDAMENTAL

MONOLITHIC CRYSTAL FILTERS

ASCF21U and ASCF45U



FEATURES:

- Surface-mount ceramic package.
- Excellent attenuation bandwidth.
- Reflow capable.
- Low height.(1.5mm max.)

APPLICATIONS:

- Mobile communication systems.
- Cellular and cordless phones.
- Pagers.
- Radios.

STANDARD SPECIFICATIONS

ABRACON PART NO.	POLE	PASSBAND		STOPBAND		RIPPLE dB	LOSS dB	TERMINATING IMPEDANCE (Ω // pF)
		dB	kHz	dB	kHz			
ASCF21U8	2	3	±3.75	20	±18.0	1.0	2.0	(850 // 5.0)
ASCF21U15	2	3	±7.50	18	±25.0	1.0	2.0	(1500 // 1.0)
ASCF21U20	2	3	±10.0	10	±30.0	1.0	2.0	(1800 // 1.0)
ASCF21U30	2	3	±15.0	15	±45.0	1.0	2.0	(2000 // 1.5)

STANDARD SPECIFICATIONS

ABRACON PART NO.	POLE	PASSBAND		STOPBAND		RIPPLE dB	LOSS dB	TERMINATING IMPEDANCE (Ω // pF)
		dB	kHz	dB	kHz			
ASCF45U8	2	3	±3.75	20	±25.0	1.0	2.5	(650 // 3.5)
ASCF45U12	2	3	±6.00	15	±20.0	1.0	2.5	(650 // 5.0)
ASCF45U15	2	3	±7.50	15	±25.0	1.0	2.5	(650 // 3.5)
ASCF45U30	2	3	±15.0	15	±60.0	1.0	2.5	(1200 // -3.0)

Operating Temperature: -20°C to + 70°C.

Environmental and mechanical specifications, see appendix C. Group 2.

Applications notes, see appendix A.

Tape and reel, see appendix H.

Marking, see appendix G.

Recommended handling, see appendix F.

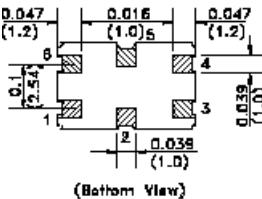
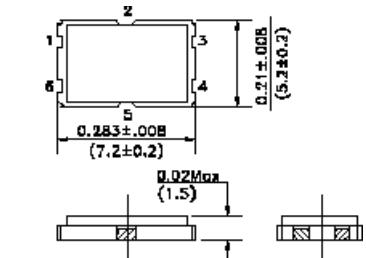
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ORDERING OPTIONS

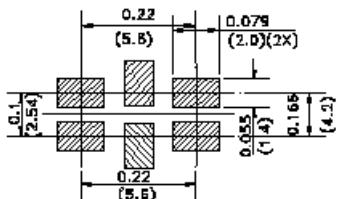
ASCFXXU XX - Packaging

See suffix in P/N -T for Tape and reel

21 or 45



Recommended Land Pattern



Dimensions: Inches (mm)

PIN	FUNCTION
1	IN
2	GND
3	GND
4	OUT
5	GND
6	GND

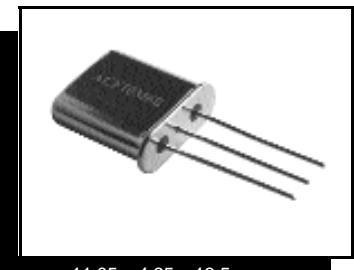
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11.05 x 4.65 x 13.5 mm

10.7MHz MONOLITHIC CRYSTAL FILTERS ACF10M Series

FEATURES:

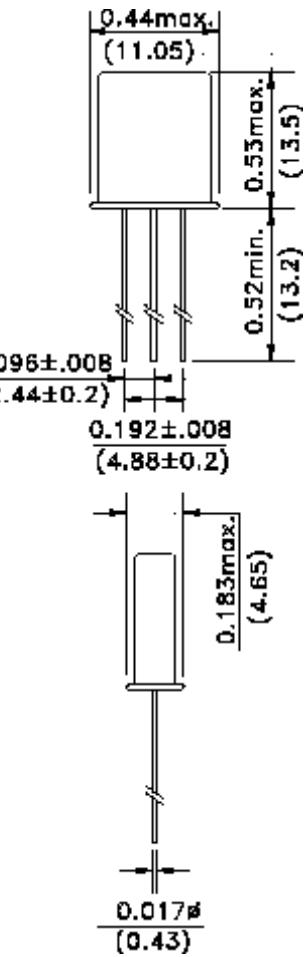
- Excellent attenuation bandwidth.
- Compact design.

APPLICATIONS:

- Mobile communication systems.
- Cellular and cordless phones.
- Pagers.
- Radios.

STANDARD SPECIFICATIONS

ABRACON P/N	POLE	PASSBAND		STOPBAND		RIPPLE dB	LOSS dB	TERMINATING IMPEDANCE*	PACKAGE CONF.
		dB	kHz	dB	kHz				
8 Series CHANNEL SPACING: 12.5kHz									
ACF10M 8A	2	3	± 3.75	20	±18.0			0.5	1.5
ACF10M 8B	4	3	± 3.75	40	±14.0			1.0	2.5
ACF10M 8C	6	3	± 3.75	45	± 8.75	65	±12.5	2.0	3.0
ACF10M 8D	8	3	± 3.75	65	± 8.75	90	±12.5	2.0	4.0
ACF10M 8E	10	6	± 3.75	75	± 8.75	90	±10.5	2.0	5.0
12 Series CHANNEL SPACING: 20.0kHz									
ACF10M 12A	2	3	± 6.0	20	±25.0			0.5	1.5
ACF10M 12B	4	3	± 6.0	40	±20.0			1.0	2.5
ACF10M 12C	6	3	± 6.0	45	±14.0	65	±20.0	2.0	3.5
ACF10M 12D	8	3	± 6.0	65	±14.0	90	±20.0	2.0	4.0
ACF10M 12E	10	6	± 6.0	75	±14.0	90	±16.0	2.0	5.0
15 Series CHANNEL SPACING: 25.0kHz									
ACF10M 15A	2	3	± 7.5	18	±25.0			0.5	1.5
ACF10M 15B	4	3	± 7.5	40	±25.0			1.0	2.5
ACF10M 15C	6	3	± 7.5	45	±17.5	65	±25.0	2.0	3.0
ACF10M 15D	8	3	± 7.5	65	±17.5	90	±25.0	2.0	4.0
ACF10M 15E	10	6	± 7.5	75	±16.0	90	±18.0	2.0	5.0
30 Series CHANNEL SPACING: 50.0kHz									
ACF10M 30A	2	3	± 15.0	15	±50.0			0.5	1.5
ACF10M 30B	4	3	± 15.0	30	±40.0			1.0	2.5
ACF10M 30C	6	3	± 15.0	60	±45.0			2.0	3.0
ACF10M 30D	8	3	± 15.0	60	±30.0	90	±50.0	2.0	4.0



Dimensions: Inches (mm)

PACKAGE CONFIGURATION		
PACKAGE TITLE	A Inches (mm)	L Inches (mm)
L1	0.35 (9.0)	0.59 (15.0)
L2	0.53 (13.4)	0.73 (18.5)
L3	0.7 (17.8)	0.91 (23.0)

PACKAGE CONFIGURATION		
PACKAGE TITLE	A Inches (mm)	L Inches (mm)
M1	0.24 (6.0)	0.39 (9.8)
M2	0.35 (8.6)	0.53 (13.4)
M3	0.47 (11.8)	0.63 (16.0)

PACKAGE CONFIGURATION		
PACKAGE TITLE	A Inches (mm)	L Inches (mm)
S1	0.20 (5.0)	0.34 (8.5)
S2	0.30 (7.4)	0.40 (11.0)
S3	0.39 (9.8)	0.53 (13.4)

* Terminating Impedance = (Ω) // (pF) Operating Temperature: -20°C to +70°C.

Test circuit, waveforms, see appendix B. Application notes, see appendix A. Environmental and mechanical specifications, see appendix C. Group 1.

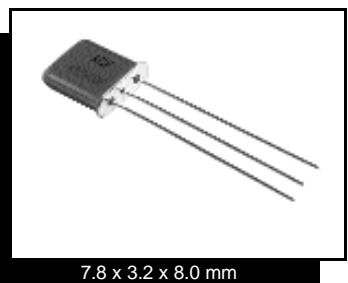
Marking, see appendix G. Recommended handling, see appendix F.

**We Manufacture to your Custom Specifications.
Please Call for Details.**

21.4MHz and 45MHz

MONOLITHIC CRYSTAL FILTERS

ACF21U and ACF45U Series



7.8 x 3.2 x 8.0 mm

FEATURES:

- Excellent attenuation bandwidth.
- Compact design.

APPLICATIONS:

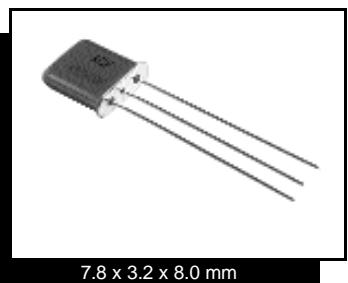
- Mobile communication systems.
- Cellular and cordless phones.
- Pagers.
- Radios.

MCF 21.4MHz FUNDAMENTAL SERIES

ABRACON PART NO.	POLE	PASSBAND		STOPBAND			RIPPLE dB	LOSS dB	TERMINATING IMPEDANCE*	PACKAGE CONF.
		dB	kHz	dB	kHz	dB				
8 Series CHANNEL SPACING: 12.5kHz										
ACF21U 8A	2	3	±3.75	20	±18.0		0.5	1.5	850 // 6	UM-1.3x1
ACF21U 8B	4	3	±3.75	40	±14.0		1.0	2.5	850 // 5	UM-1.3x2
ACF21U 8C	6	3	±3.75	45	±8.75	65	±12.5	2.0	3.0	850 // 5
ACF21U 8D	8	3	±3.75	65	±8.75	90	±12.5	2.0	4.0	850 // 5
ACF21U 8E	10	6	±3.75	75	±8.75	90	±10.5	2.0	5.0	850 // 5
12 Series CHANNEL SPACING: 20.0kHz										
ACF21U 12A	2	3	±6.0	20	±25.0		0.5	1.5	1200 // 3	UM-1.3x1
ACF21U 12B	4	3	±6.0	40	±20.0		1.0	2.5	1200 // 2.5	UM-1.3x2
ACF21U 12C	6	3	±6.0	45	±14.0	65	±20.0	2.0	3.0	1200 // 2.5
ACF21U 12D	8	3	±6.0	65	±14.0	90	±20.0	2.0	4.0	1200 // 2.5
ACF21U 12E	10	6	±6.0	75	±14.0	90	±20.0	2.0	5.0	1200 // 2.5
15 Series CHANNEL SPACING: 25.0kHz										
ACF21U 15A	2	3	±7.5	18	±25.0		0.5	1.5	1500 // 2.5	UM-1.3x1
ACF21U 15B	4	3	±7.5	40	±25.0		1.0	2.5	1500 // 2.0	UM-1.3x2
ACF21U 15C	6	3	±7.5	45	±17.5	65	±25.0	2.0	3.0	1500 // 2.0
ACF21U 15D	8	3	±7.5	65	±17.5	90	±25.0	2.0	4.0	1500 // 2.0
ACF21U 15E	10	6	±7.5	75	±16.0	90	±18.0	2.0	5.0	1500 // 2.0
30 Series CHANNEL SPACING: 50.0kHz										
ACF21U 30A	2	3	±15.0	15	±45		0.5	1.5	1500 // 1.0	UM-1.3x1
ACF21U 30B	4	3	±15.0	40	±50		1.0	2.5	2200 // 0.5	UM-1.3x2
ACF21U 30C	6	3	±15.0	45	±35	65	±50.0	2.0	3.0	2200 // 0.5
ACF21U 30D	8	3	±15.0	68	±30	80	±50.0	2.0	4.0	2200 // 0.5

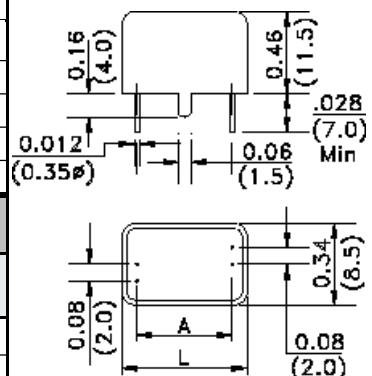
MCF 45MHz FUNDAMENTAL SERIES

ABRACON PART NO.	POLE	PASSBAND		STOPBAND			RIPPLE dB	LOSS dB	TERMINATING IMPEDANCE*	PACKAGE CONF.
		dB	kHz	dB	kHz	dB				
ACF45U 8A	2	3	±3.75	10	±12.5	65	-910	1.0	2.0	200//4
ACF45U 8B	4	3	±3.75	30	±12.5	90	±910	1.0	4.0	350/6.5//18
ACF45U 12A	2	3	±6.0	15	±20.0	65	-910	1.0	2.0	500//5
ACF45U 12B	4	3	±6.0	35	±20.0	90	±910	1.0	3.0	500//4//12
ACF45U 15A	2	3	±7.5	35	±25.0	90	-910	1.0	3.0	650//3//9
ACF45U 15B	4	3	±7.5	35	±25.0	90	±910	1.0	3.0	650//3//9
ACF45U 30A	2	3	±15.0	10	±50.0	65	-910	1.0	2.0	1200//0
ACF45U 30B	4	3	±15.0	30	±50.0	80	±910	1.0	3.0	1200//0.7//3.5

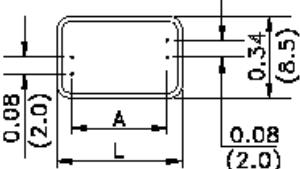


0.31max.
(7.8)
0.32max.
(8.0)
0.71min.
(18)
0.15±.008
(3.75±0.2)
0.13max.
(3.2)
0.014±
(0.35)
UM-1.3

Package Configuration Dimensions: Inches (mm)



0.16
(4.0)
0.46
(11.5)
.028
(7.0)
0.012
(0.35)
0.06
(1.5)
Min



0.08
(2.0)
0.34
(8.5)
0.08
(2.0)

Package Configuration: S or M

See page 78 for Package Configurations and Dimensions.

* Terminating Impedance = $(\Omega) // (\text{pF})$
Operating Temperature: -20°C to +70°C.

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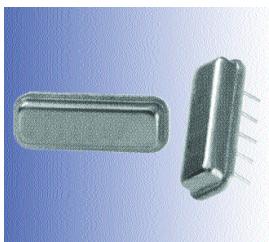
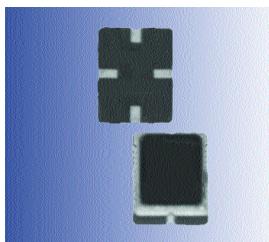
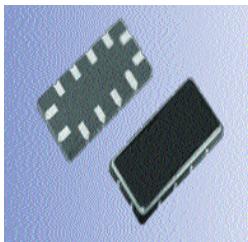
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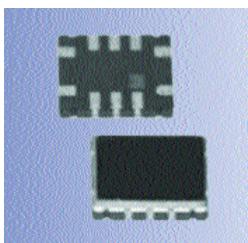
SAW DEVICES



• Mobile Phones



With the growth of wireless communications, SAW devices have become a critical component for electronics manufacturers. For 2002, Abracon is pleased to announce the addition of SAW Resonators and SAW Filters to our Frequency Control product line. With high volume off-shore manufacturing, Leading technology and Superior engineering resources in design and process manufacturing, Abracon would like to be your preferred supplier for SAW devices.

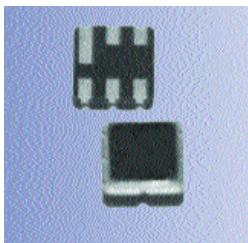


• Automotive Electronics



Our experienced engineering team can support your SAW application from the initial design through production. Custom designs are available utilizing high technology mask designs, wafer fabrication, assembly and complete reliability testing.

For immediate assistance,
Please contact Abracon Corporation or send
an email to: abinfo@abracon.com



Applications for Commercial Communications:

- Fiber Optics
- LAN Systems • Cable TV, Set-top box
- Digital Audio/Video Broadcasting (DAB)/(DVB)
- Digital Satellite Systems

• Remote Keyless Entry



Applications for Consumer Communications:

- Mobile Phones • Pagers • Wireless Lan Systems
- Remote Keyless Entry (RKE) • Security Systems
- Garage Door Opener

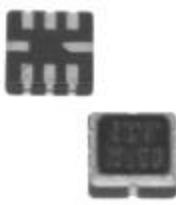
• Wireless Communications



Products offered:

- RF SAW filters (0.1GHz ~ 2GHz)
- IF SAW filters (10MHz ~ 500MHz)
- SAW resonators one port or two ports (200MHz ~ 600MHz)





5.0 x 5.0 x 1.35mm

CERAMIC SURFACE-MOUNT
SAW FILTER
AFS315E

FEATURES:

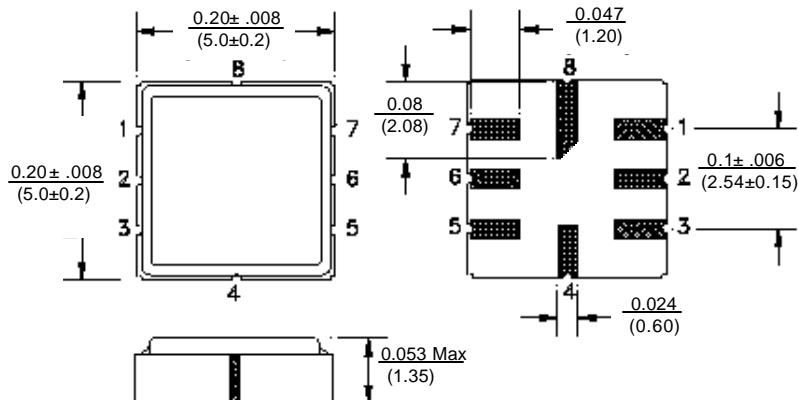
- SAW Filter 315.00 MHz. typ.
- Low Loss, Compact
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABLSOLUTE MAXIMUM RATINGS:

DC voltage	12Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm



Dimensions: Inches (mm)

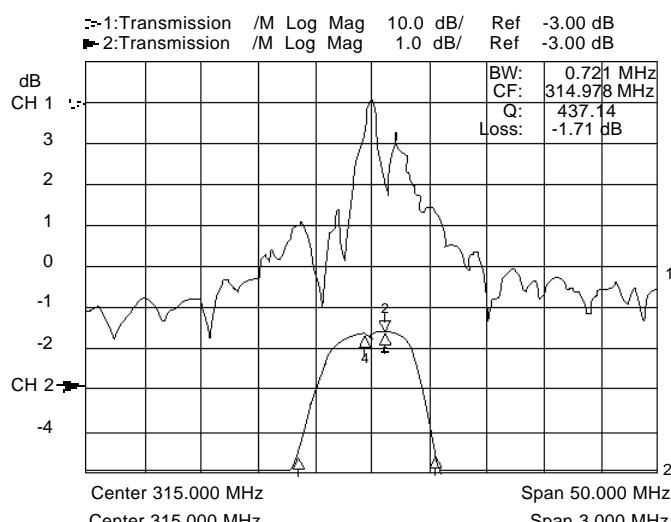
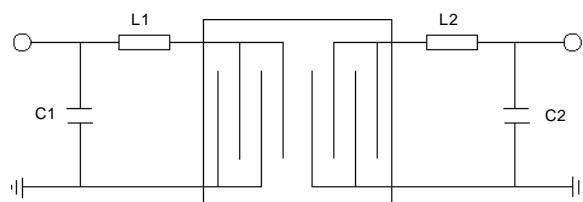
STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	315.00	-
Insertion loss	I _L	dB	-	3.0	5.5
3dB Passband	BW ₃	kHz	-	600	-
Stopband attenuation	at F _c -21.4MHz	dB	40	50	-
	at F _c -10.7MHz	dB	15	30	-
	Ultimate	dB	-	80	-
Turn-over temperature	T ₀	°C	24	39	54
Temperature coefficient	T _c	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Pin No.	Function
1	Input GND
2	Input
5	Output GND
6	Output
3, 7	To be GNDed
4, 8	Case GND

Maching circuit to 50 W:

$$C1=C2=13pF, L1=L2=80nH$$



ABRACON
CORPORATION

S1

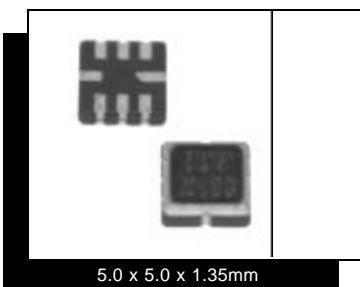
NOTE: All specifications and markings subject to change without notice

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CERAMIC SURFACE-MOUNT SAW FILTER AFS390E

5.0 x 5.0 x 1.35mm

FEATURES:

- SAW Filter 390 MHz
- Low Loss, Compact
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABLSOLUTE MAXIMUM RATINGS:

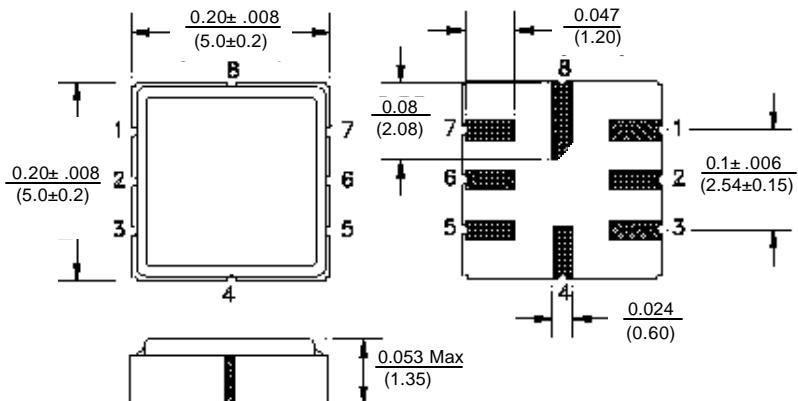
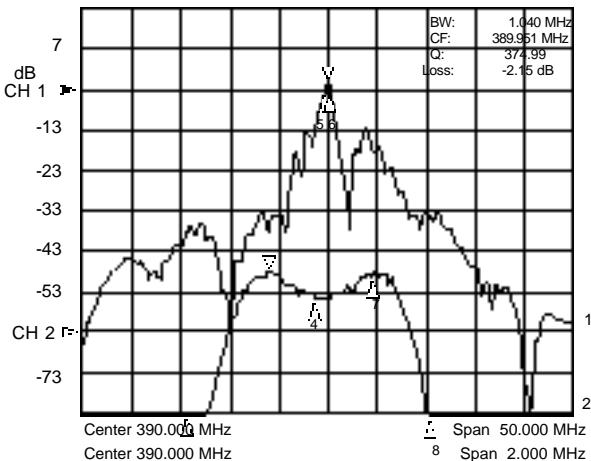
DC voltage	12Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	390	-
Insertion loss	I _L	dB	-	3.5	5.5
3dB Passband	BW ₃	kHz	-	±300	-
Stopband attenuation	at F _c -21.4MHz	dB	40	50	-
	at F _c -10.7MHz	dB	15	30	-
	Ultimate		-	80	-
Turn-over temperature	T ₀	°C	25	40	55
Temperature coefficient	T _c	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Packaging option: -T for tape and reel, see appendix H.
Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

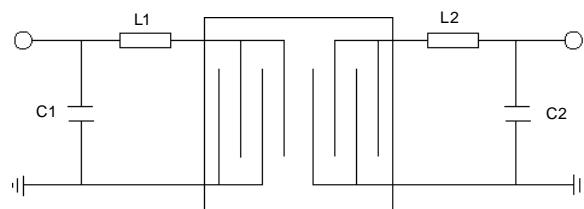
■: 1:Transmission /M Log Mag 10.0 dB/ Ref -3.00 dB
■: 2:Transmission /M Log Mag 0.5 dB/ Ref -2.61 dB



Dimensions: Inches (mm)

Pin No.	Function
1	Input GND
2	Input
5	Output GND
6	Output
3, 7	To be GNDed
4, 8	Case GND

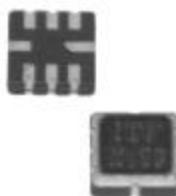
Test Circuit



C1,C2=13pF*, L1,L2=47~52nH*

*:need adjustment of customer's PCB.

Marking:
AFS
390E



5.0 x 5.0 x 1.35mm

CERAMIC SURFACE-MOUNT SAW FILTER **AFS418E**

FEATURES:

- SAW Filter 418.00MHz.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABLSOLUTE MAXIMUM RATINGS:

DC voltage	12Vdc
Operating temperature	-35°C to +85°C
Maximum power dissipation	10dBm

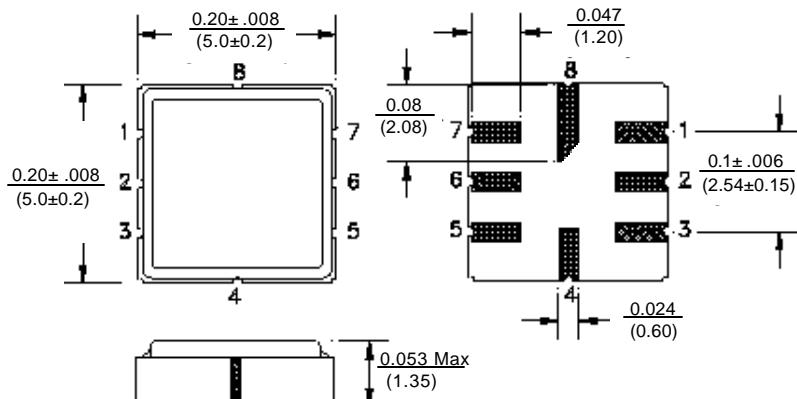
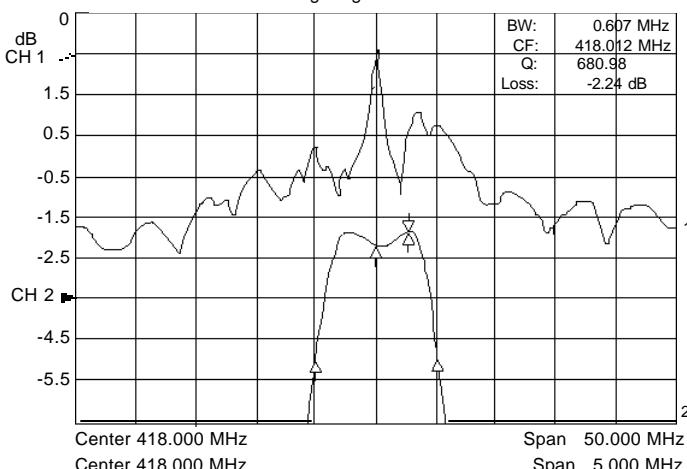
STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	418.00	-
Insertion loss	I _L	dB	-	3.5	5.0
3dB Passband	BW ₃	kHz	-	600	-
Stopband attenuation at F _c -21.4MHz	dB	dB	40	50	-
at F _c -10.7MHz	dB	dB	15	30	-
Ultimate			-	80	-
Turn-over temperature	T _o	°C	24	39	54
Temperature coefficient	T _c	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

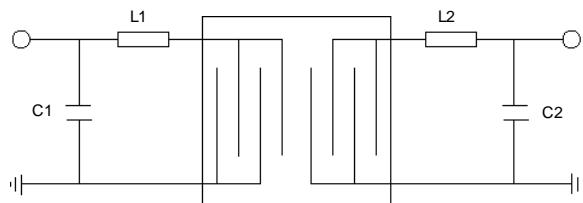
■ 1:Transmission /M Log Mag 10.0 dB/ Ref -3.50 dB
■ 2:Transmission /M Log Mag 1.0 dB/ Ref -3.50 dB



Pin No.	Function
1	Input
2	Input GND
5	Output
6	Output GND
3, 7	To be GNDed
4, 8	Case GND

Maching circuit to 50 W:

C1=C2=15pF, L1=L2=68 nH



Marking:
AFS
418E



S4

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CERAMIC SURFACE-MOUNT

SAW FILTER

AFS433E-01

FEATURES:

- SAW Filter 433.92MHz.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

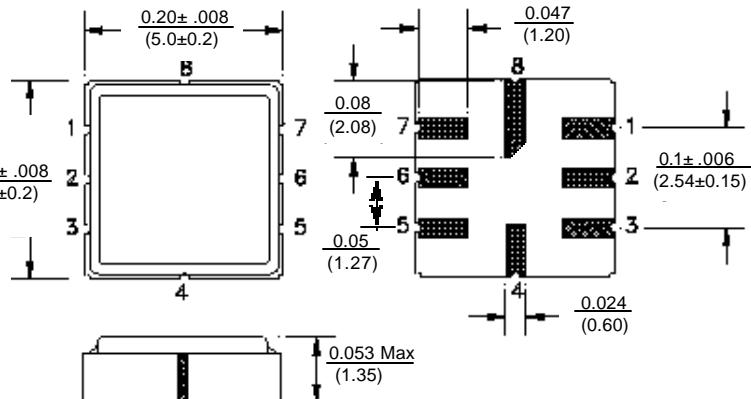
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 12 Vdc
Operating temperature	-35°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency	MHz	-	433.920	-
Insertion loss	dB	-	3.0	5.5
3dB Passband	BW3	kHz	± 300	-
3dB Reject band	BW3	kHz	-	± 500
Stopband attenuation at $F_c - 21.4\text{ MHz}$	dB	40	50	-
Stopband attenuation at $F_c - 10.7\text{ MHz}$	dB	15	30	-
Ultimate		-	80	-
Turn-over temperature	To	°C	24	39
Temperature coefficient	Tc	ppm/C°	-	0.032
Aging absolute first year	[A]	ppm	-	10

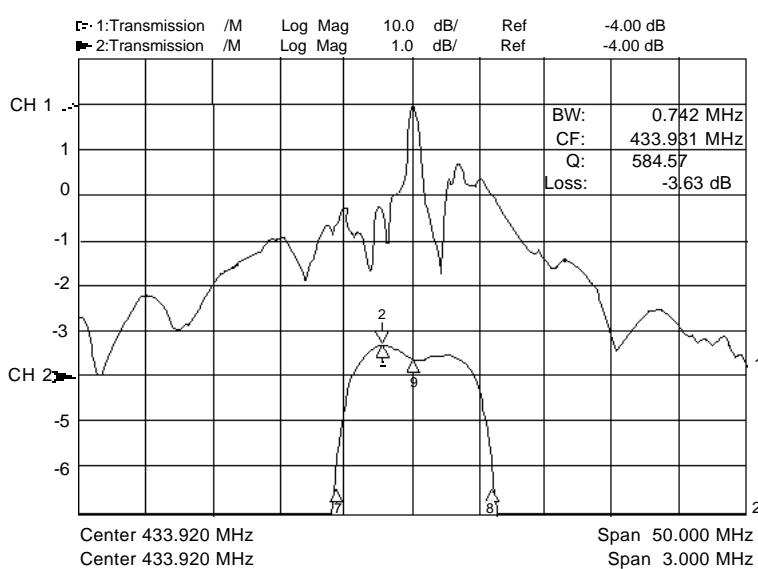
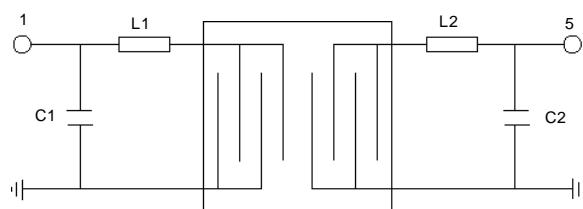


Dimensions: Inches (mm)

Pin No.	Function
1	Input
2	Input GND
5	Output
6	Output GND
3, 7	To be GNDed
4, 8	Case GND

Maching circuit to 50 W:

$C_1=C_2=13\text{pF}$, $L_1=L_2=43\text{nH}$



Marking:
AFS
433E

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CERAMIC SURFACE-MOUNT

SAW FILTER

AFS433E-02

FEATURES:

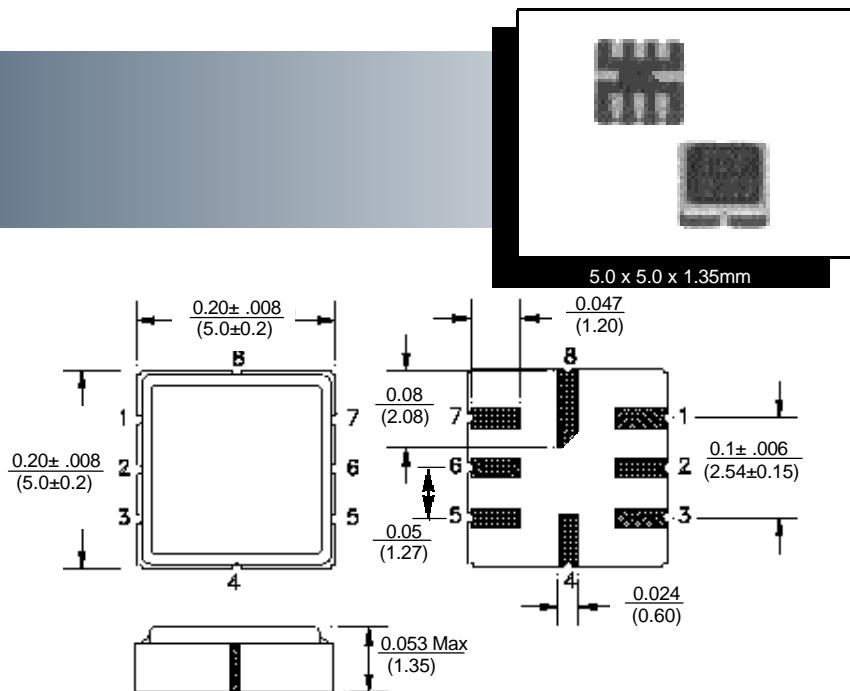
- SAW Filter 433.92MHz.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

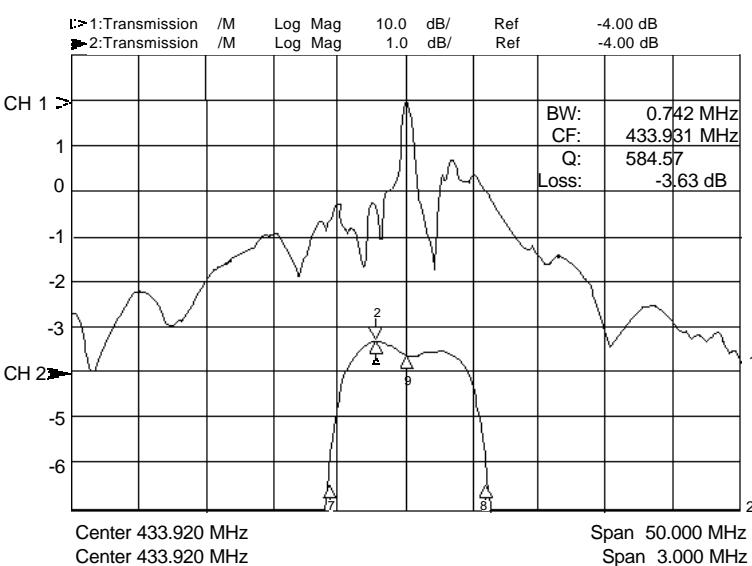
DC voltage	± 12 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm



Dimensions: Inches (mm)

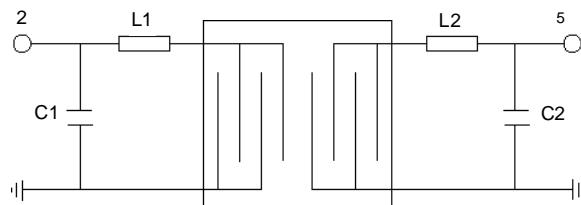
Pin No.	Function
1	Input GND
2	Input
5	Output
6	Output GND
3, 7	To be GNDed
4, 8	Case GND

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	433.920	-
Insertion loss	I _L	dB	-	3.0	5.5
3dB Passband	BW ₃	kHz	-	± 300	-
3dB Reject band	BW ₃	kHz	-	-	± 500
Stopband attenuation at F _c =21.4MHz	dB	40	50	-	-
at F _c =10.7MHz	dB	15	30	-	-
Ultimate		-	80	-	-
Turn-over temperature	T ₀	°C	24	39	54
Temperature coefficient	T _c	ppm/C°	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10



Maching circuit to 50 W:

C₁=C₂=13pF, L₁=L₂=43 nH



Marking:
AFS
433E-2

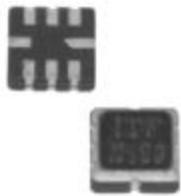
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5.0 x 5.0 x 1.35mm

CERAMIC SURFACE-MOUNT

SAW FILTER

AFS868.35E

FEATURES:

- SAW Filter 868.35MHz.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 12 Vdc
Operating temperature	-35°C to +85°C
Maximum power dissipation	10dBm

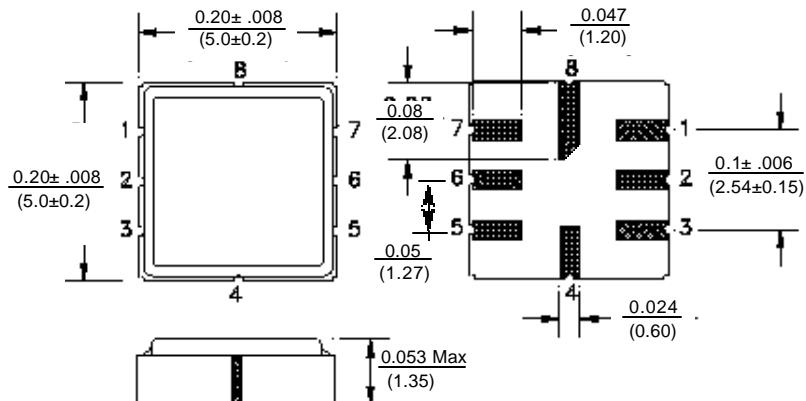
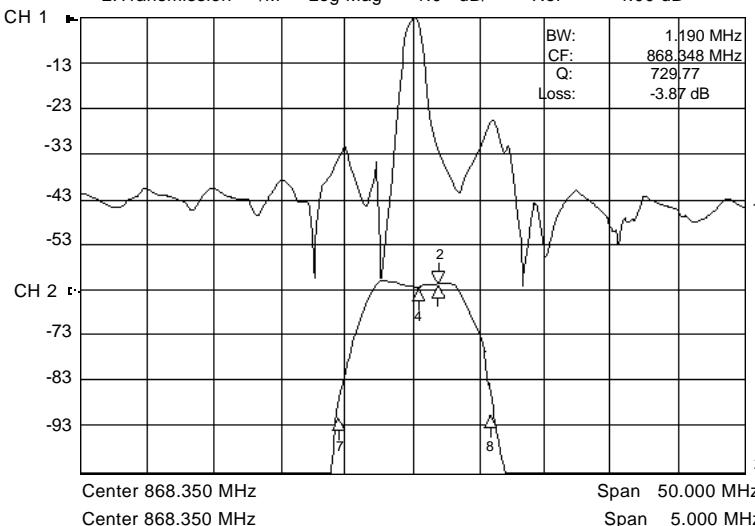
STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	868.35	-
Insertion loss	I _L	dB	-	4.0	5.5
3dB Pass band	BW ₃	kHz	-	1,200	-
Stopband attenuation	at F _c -21.4MHz	dB	30	40	-
	at F _c -10.7MHz	dB	15	30	-
	Ultimate		-	60	-
Turn-over temperature	T _o	°C	25	40	55
Temperature coefficient	T _c	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, Environmental and mechanical specifications, see page 91 in the Abracon Catalog

■ 1:Transmission /M Log Mag 10.0 dB/ Ref -3.00 dB
■ 2:Transmission /M Log Mag 1.0 dB/ Ref -4.00 dB

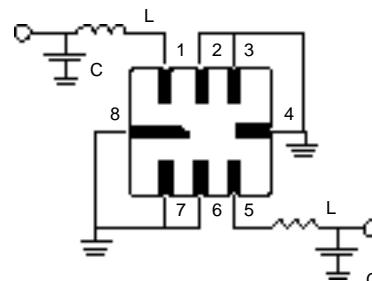


Dimensions: Inches (mm)

Pin No.	Function
1	Input
2	Input GND
5	Output
6	Output GND
3, 7	To be GNDed
4, 8	Case GND

Maching circuit to 50 W:

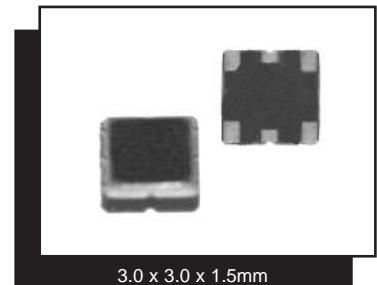
C=4-8 pF, L=2 turns of 0.5mm insulated copper, 3.0 ID (nH)



Marking:

AFS
868.35E

**CERAMIC SURFACE-MOUNT
SAW FILTER
AFS915D**



FEATURES:

- SAW Filter 915.000 MHz.typ.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

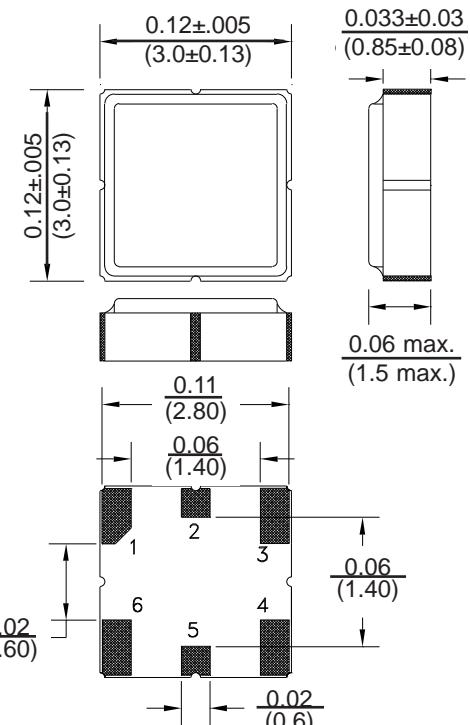
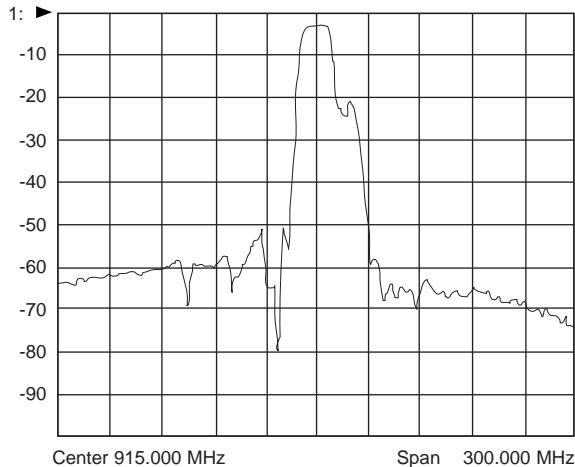
DC voltage	+10Vdc
Operating temperature	-30°C to +80°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	Fc	MHz	-	915.000	-
Insertion loss	IL	dB	-	3.2	3.5
3dB Passband	BW3	kHz	-	7000	-
Stopband attenuation	at DC - 600MHz	dB	50	66	-
	at 600 - 840MHz	dB	40	35	-
	at 840 - 894MHz	dB	35	40	-
	at 970-1500MHz	dB	40	45	-
	at 1500-3000MHz	dB	25	28	-
Turn-over temperature	To	°C	24	39	54
Temperature coefficient	Tc	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Packaging option: -T for tape and reel, see appendix H.
Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

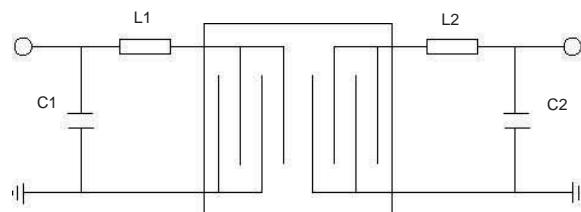
► 1:Transmission Log Mag 10.0 dB/ Ref 0.00 dB C
► 2:off



Pin No.	Function
1	GND
2	Input
3	GND
4	GND
5	Output
6	GND

Maching circuit to 50 W:

Terminating Impedance = $50 + j57.4$
C1=C2=2-4 pF, L1=L2=2-3 nH



Marking:

AFS
915.D

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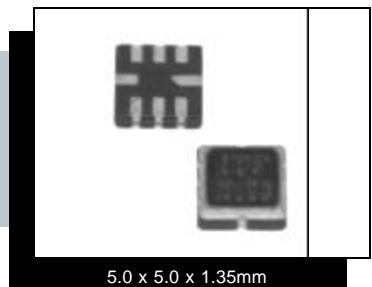
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CERAMIC SURFACE-MOUNT

SAW FILTER

AFS916.5E



5.0 x 5.0 x 1.35mm

FEATURES:

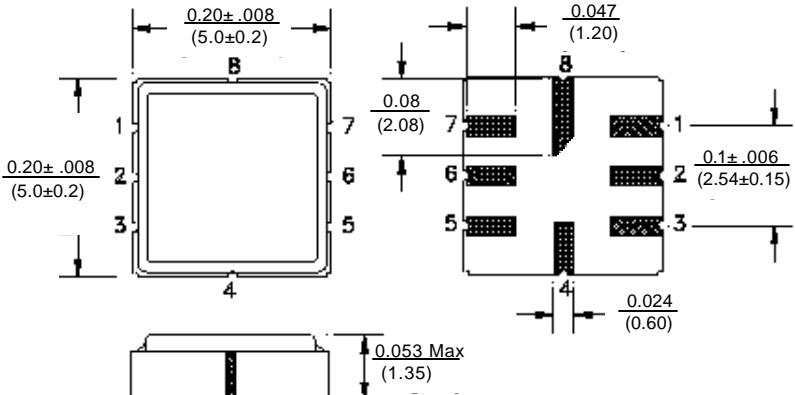
- SAW Filter 916.5 MHz.typ.
- Low Loss, Compact.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	12Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm



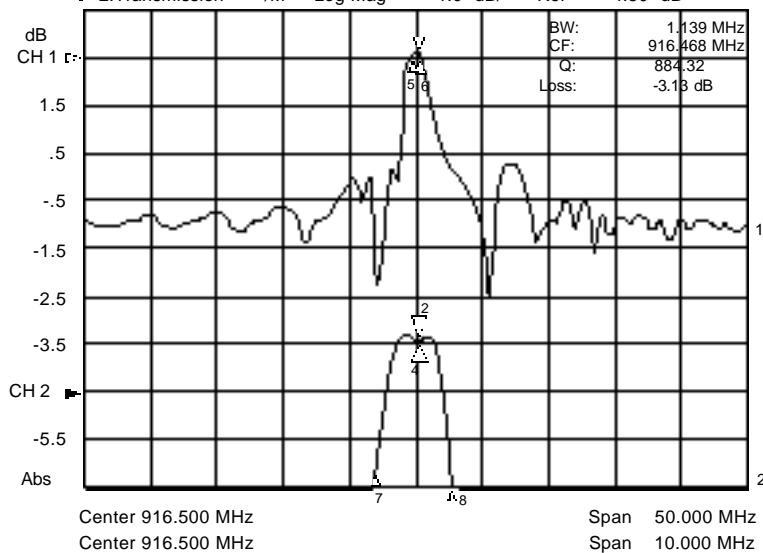
STANDARD SPECIFICATIONS

CHARACTERISTICS		UNIT	min.	typ.	max.
Center frequency	F _c	MHz	-	916.5	-
Insertion loss	I _L	dB	-	4.0	5.5
3dB Passband	BW ₃	kHz	-	1200	-
Stopband attenuation at F _c -21.4MHz	dB	-	35	-	-
at F _c -10.7MHz	dB	-	35	-	-
Ultimate			-	50	-
Turn-over temperature	T _o	°C	25	40	55
Temperature coefficient	T _c	ppm/C ²	-	0.032	-
Aging absolute first year	[A]	ppm	-	-	10

Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

→ 1:Transmission /M Log Mag 10.0 dB/ Ref -4.50 dB
→ 2:Transmission /M Log Mag 1.0 dB/ Ref -4.50 dB

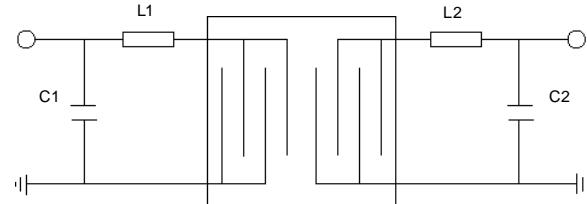


Dimensions: Inches (mm)

Pin No.	Function
1	Input GND
2	Input
5	Output GND
6	Output
3, 7	To be GNDed
4, 8	Case GND

Maching circuit to 50 W:

C1=C2=4~8pF*, L1=L2=80H
L=2 turns of 0.5mm insulated copper, 2.5ID(nH)



Marking:

AFS
916.5E

1: Mkr Δ (MHz)	dB	2: Mkr Δ (MHz)	dB
1> 0.00	0.00	2> 0.00	0.00
2: 0.05	-0.05	3: -0.06	-0.03
3: -0.06	-0.03	4: -0.03	-0.02
4: -0.03	-0.02	5: -0.64	-3.00
5: -0.64	-3.00	6: 0.52	-3.00
6: 0.52	-3.00	7: -0.60	-2.61
7: -0.60	-2.61	8: 0.54	-3.35
8: 0.54	-3.35	7: -0.65	-2.66
		8: 0.49	-3.54

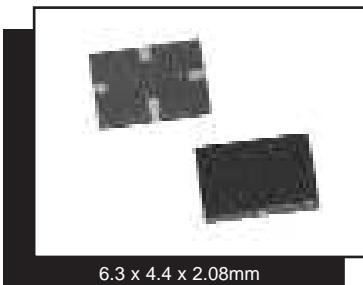
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CORPORATION



6.3 x 4.4 x 2.08mm

CERAMIC SURFACE-MOUNT SAW RESONATORS ASR310S2

FEATURES:

- One-port SAW resonator 310.0 MHz.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 310.0 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30\text{Vdc}$
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

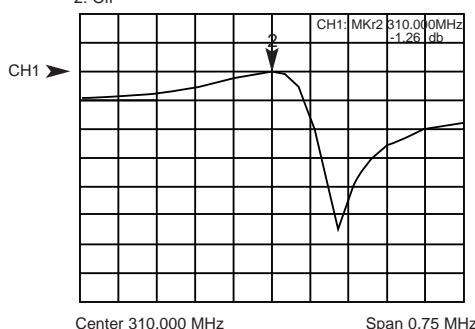
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency	MHz	309.925	310.000	310.075
Insertion loss	dB	-	1.5	2.2
Shunt capacitance	pF	1.8	2.1	2.4
Motional resistance	W	-	19	29
Motional inductance	uH	-	118.143	-
Motional capacitance	fF	-	2.2333	-
Turn-over temperature	°C	24	39	54
Temperature coefficient	ppm/C ²	-	0.037	-
Aging per year	ppm/yr	-	-	10
DC insulation resistance	MW	1.0	-	-

Packaging option: -T for tape and reel, see appendix H.

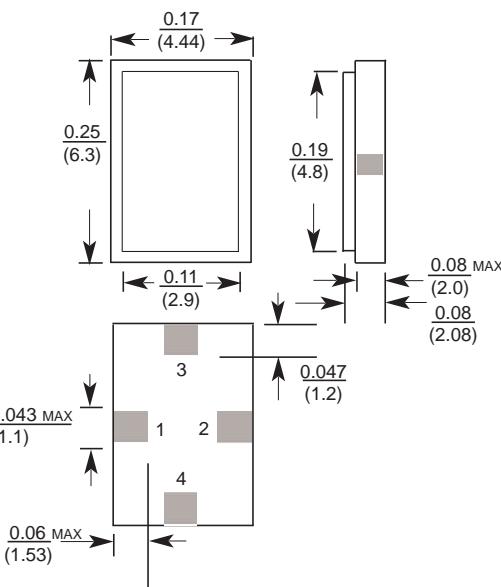
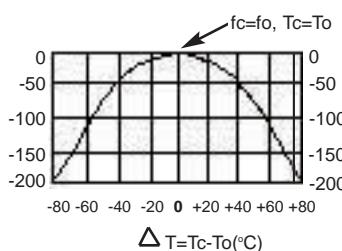
Reflow profile, see appendix E. Reliability specifications, Environmental and mechanical specifications, see page 91 in the Abracon Catalog

Typical Frequency Response

1:Transmission /M Log Mag 5.0 dB/ Ref -1.50 dB
2: Off



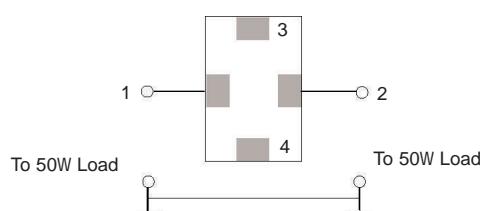
Temperature Characteristics



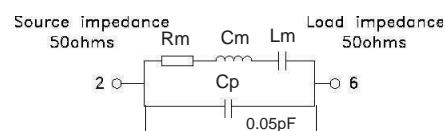
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3 & 4	Case GND

Test circuit:



Equivalent circuit:



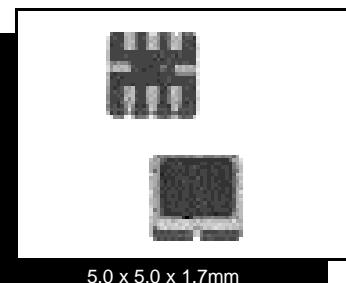
Marking:

310S2
AZY
(ZY: Date code)

CERAMIC SURFACE-MOUNT, ONE-PORT

SAW RESONATORS

ASR315E and ASR433E



FEATURES:

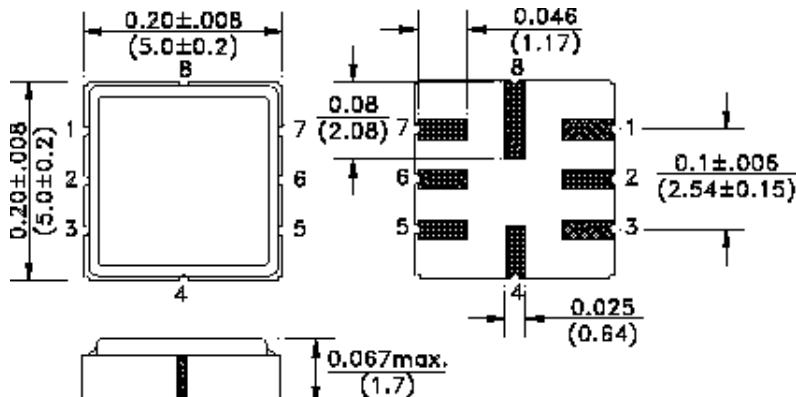
- One-port SAW resonator 315MHz and 433.92MHz. See page 87- 88 for additional frequencies.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	12V
Operating temperature	-20°C to +85°C
Storage temperature	-40°C to +85°C
Maximum power dissipation	0dBm



STANDARD SPECIFICATIONS

PART NUMBER	ASR315E				ASR433E			
	CHARACTERISTICS	UNIT	min.	typ.	max.	min.	typ.	max.
Center frequency	Fr	MHz	314.925	315	315.075	433.845	433.92	433.995
Insertion loss	IL	dB	-	1.6	2.5	-	1.3	2.0
Shunt capacitance	Co	pF	3.5	3.65	4.5	-	3.2	-
Motional resistance	R1	Ω	-	20.67	29	-	13.2	20
Motional inductance	L1	µH	-	100.7	-	-	66	-
Motional capacitance	C1	fF	-	2.54	-	-	2.05	-
Turn-over temperature	To	°C	-	35	-	-	35	-
Temperature coefficient	Tc	ppm/C ²	-	0.032	-	-	0.032	-

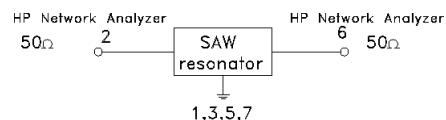
Pin No.	Function
2	Input
6	Output
4, 8 *	Case GND
1, 3, 5, 7	GND

* A dot could be present next to pin 8 for identification.

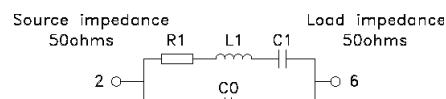
Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

Test circuit:



Equivalent circuit:



Marking:

315E
AZY

433E
AZY

Dimensions: Inches (mm)

(ZY: Date code)

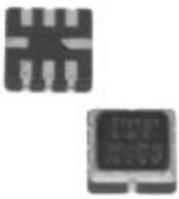
NOTE: All specifications and markings subject to change without notice

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ABRACON
CORPORATION



5.0 x 5.0 x 1.35mm

CERAMIC SURFACE-MOUNT, ONE-PORT SAW RESONATORS ASR315EA

FEATURES:

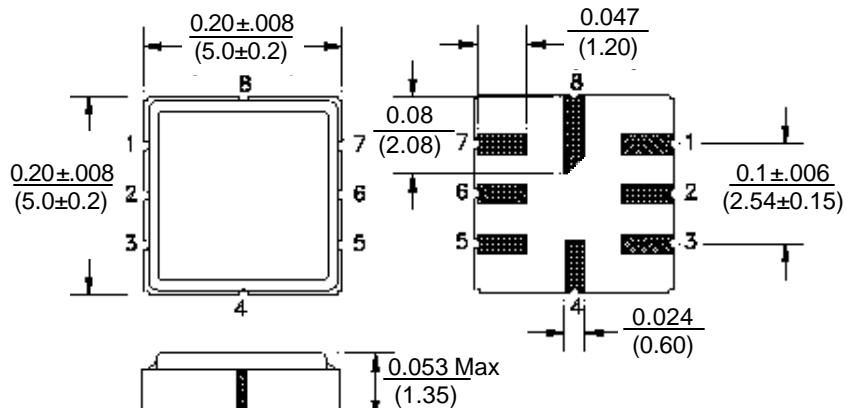
- One-port SAW resonator 315.0 MHz. Fundamental mode.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 315.0 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm



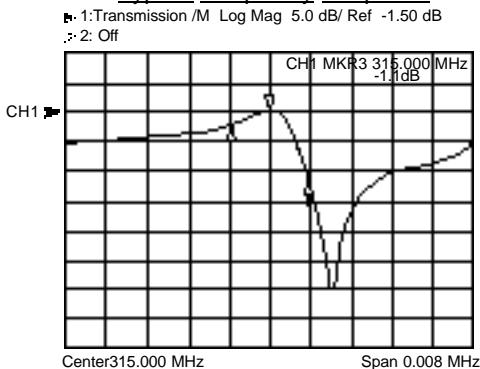
Dimensions: Inches (mm)

STANDARD SPECIFICATIONS

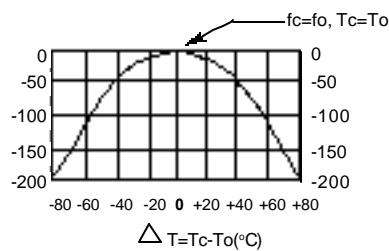
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	314.925	315.000	315.075
Tolerance from 315 MHz Δf_C	kHz	-	±75	-
Insertion loss IL	dB	-	1.5	2.2
Unloaded quality factor Q _U	-	-	12,400	-
loaded quality factor 50Ω Q _L	-	-	2,000	-
Aging absolute first year [A]	ppm	-	-	10
Shunt capacitance C ₀	pF	-	2.7	-
Motional resistance R ₁	Ω	-	20	30
Motional inductance L ₁	μH	-	121.311	-
Motional capacitance C ₁	fF	-	2.1240	-
Turnover temperature T ₀	°C	25	40	55
Temperature coefficient T _c	ppm/C ²	-	0.037	-
DC insulation resistance	MΩ	1.0	-	-

Reliability specifications, see SAW application notes.

Typical Frequency Response

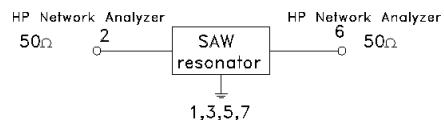


Temperature Characteristics

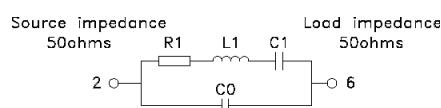


Marking:

ASR
315EA



Equivalent circuit:



CERAMIC SURFACE-MOUNT, ONE-PORT

SAW RESONATORS

ASR315S2

FEATURES:

- SAW resonator 315.0 MHz, Fundamental mode.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 315.0 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30\text{Vdc}$
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

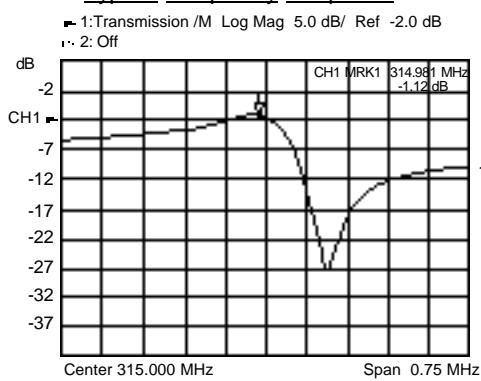
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency F _c	MHz	314.925	315.000	315.075
Tolerance from 315 MHz Δf_c	kHz	-	± 75	-
Insertion loss IL	dB	-	1.5	2.0
Unloaded quality factor Q _U	-	-	13,900	-
Loaded quality factor 50Ω Q _L	-	-	2,100	-
Shunt capacitance C ₀	pF	-	2.6	-
Motional resistance R ₁	Ω	-	19	29
Motional inductance L ₁	μH	-	96.199	-
Motional capacitance C ₁	fF	-	2.8392	-
Turn-over temperature T ₀	°C	25	40	55
Temperature coefficient T _c	ppm/C ²	-	0.032	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	MΩ	1.0	-	-

Packaging option: -T for tape and reel, see appendix H.

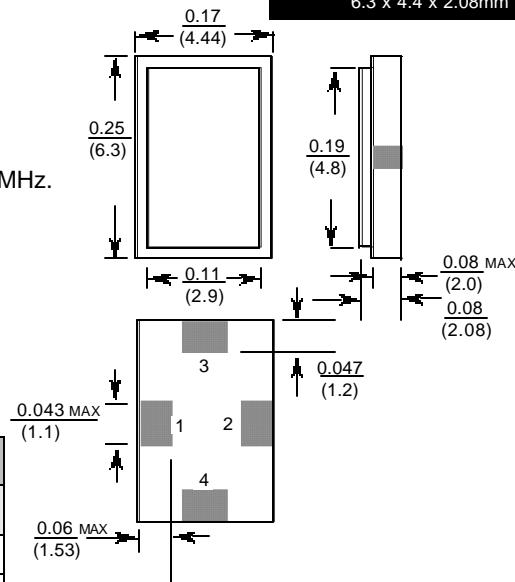
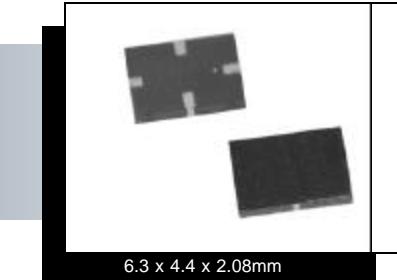
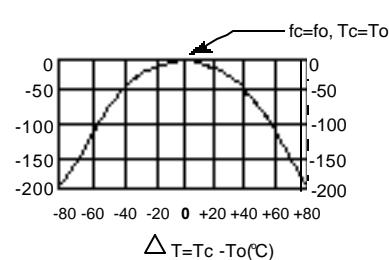
Reflow profile, see appendix E. Reliability specifications,

Environmental and mechanical specifications, see page 91 in the Abracon Catalog

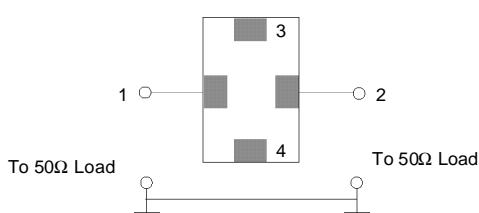
Typical Frequency Response



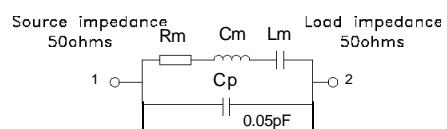
Temperature Characteristics



Test circuit:



Equivalent circuit:



Marking:

ASR
315S2



6.3 x 4.4 x 2.08mm

CERAMIC SURFACE-MOUNT SAW RESONATORS **ASR318S2**

FEATURES:

- One-port SAW resonator 318.0 MHz.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 318.0 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

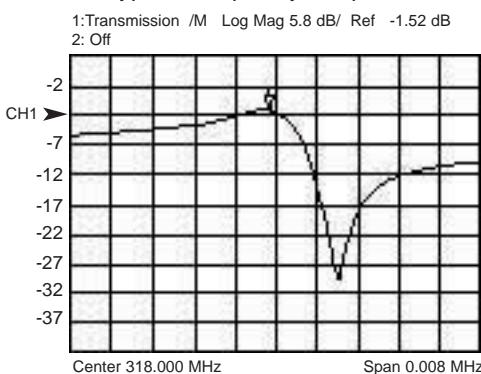
CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	317.925	318.000	318.075
Insertion loss	dB	-	1.3	2.0
Unloaded quality factor	Q	-	8,340	-
loaded quality factor	LQ	-	1150	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	-	3.0	-
Motional resistance	W	-	16	26
Motional inductance	mH	-	66.799	-
Motional capacitance	fF	-	3.7537	-
Turn-over temperature	°C	25	40	55
Temperature coefficient	ppm/C ²	-	0.032	-

Packaging option: -T for tape and reel, see appendix H.

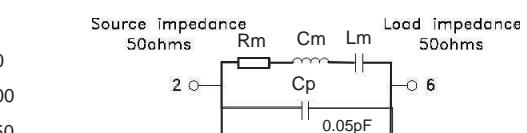
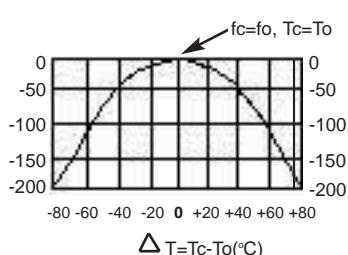
Reflow profile, see appendix E. Reliability specifications,

Environmental and mechanical specifications, see page 91 in the Abracon Catalog

Typical Frequency Response



Temperature Characteristics



Marking:

318

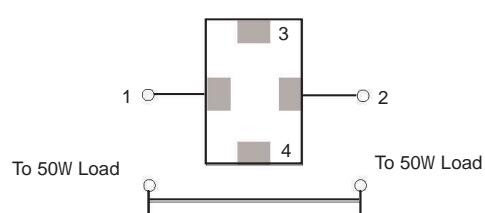
AZY

(ZY: Date code)

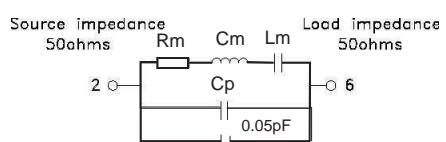
Dimensions: Inches (mm)

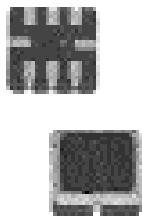
Pin No.	Function
1	Input/Output
2	Output/Input
3 & 4	Case GND

Test circuit:



Equivalent circuit:





5.0 x 5.0 x 1.7mm

CERAMIC SURFACE-MOUNT, ONE-PORT

SAW RESONATORS

ASR390E and ASR868E

FEATURES:

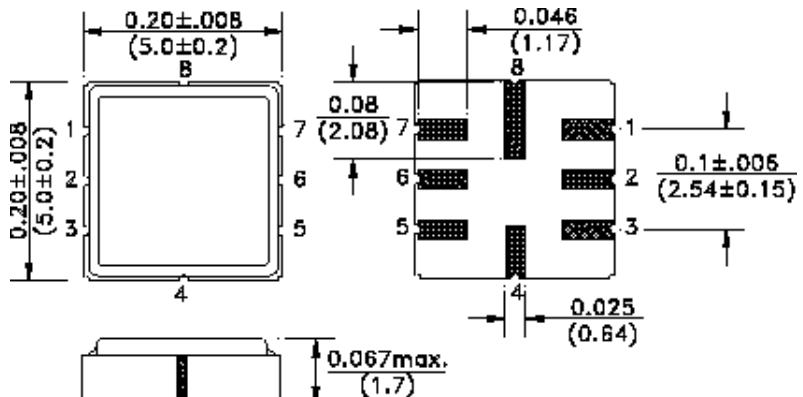
- One-port SAW resonator 390MHz and 868.35MHz. See page 87- 88 for additional frequencies.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	12V
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +85°C
Maximum power dissipation	0dBm



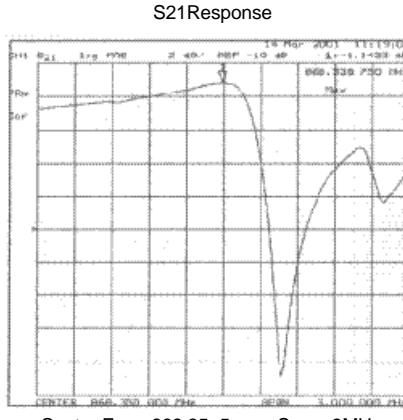
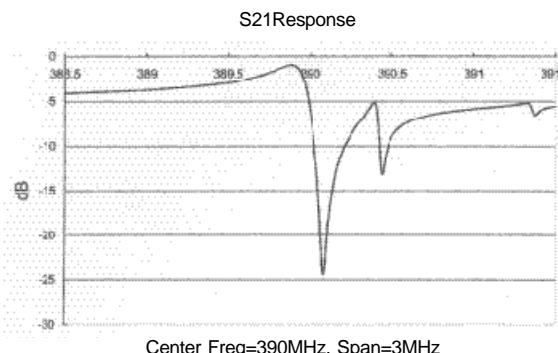
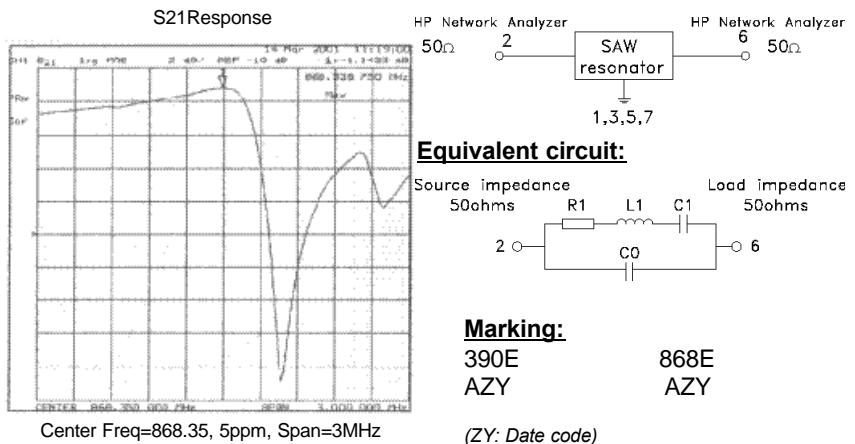
STANDARD SPECIFICATIONS

PART NUMBER		ASR390E			ASR868E		
CHARACTERISTICS	UNIT	min.	typ.	max.	min.	typ.	max.
Center frequency	MHz	389.9	390	390.1	868.275	868.35	868.425
Insertion loss	dB	-	1.5	2.5	-	1.5	2.5
Unloaded quality factor	Q	-	6000	-	6000	-	-
Shunt capacitance	pF		3.6	-	-	2.4	-
Motional resistance	Ω	-	14	-	-	16.5	-
Motional inductance	μH	-	70.5	-	-	22.73	-
Motional capacitance	fF	-	2.37	-	-	1.48	-

Pin No.	Function
2	Input
6	Output
4, 8	Case GND
1, 3, 5, 7	GND

Packaging option: -T for tape and reel, see appendix H.
Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

Test circuit:

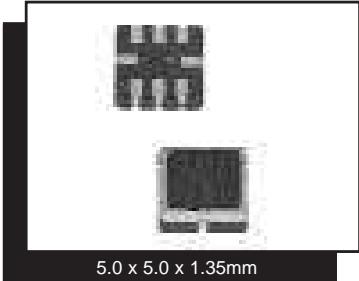


NOTE: Left blank if standard • All specifications and markings subject to change without notice

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CERAMIC SURFACE-MOUNT, ONE-PORT SAW RESONATORS **ASR403.55E**

5.0 x 5.0 x 1.35mm

FEATURES:

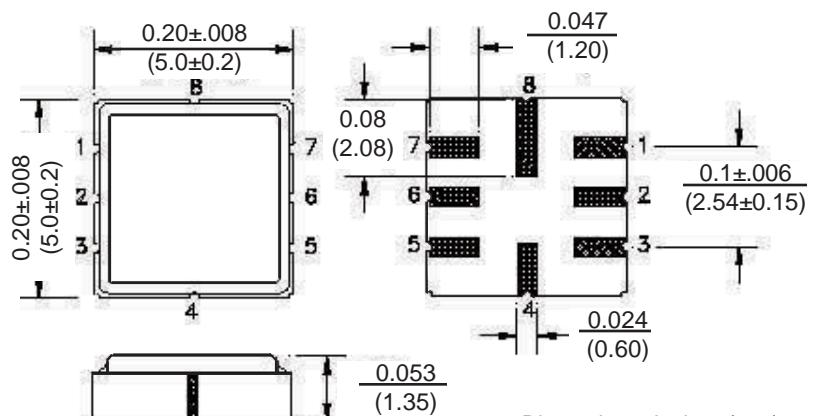
- One-port SAW resonator 403.55MHz. See page 87- 88 for additional frequencies.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30V$
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +85°C
Maximum power dissipation	10dBm



Dimensions: Inches (mm)

STANDARD SPECIFICATIONS

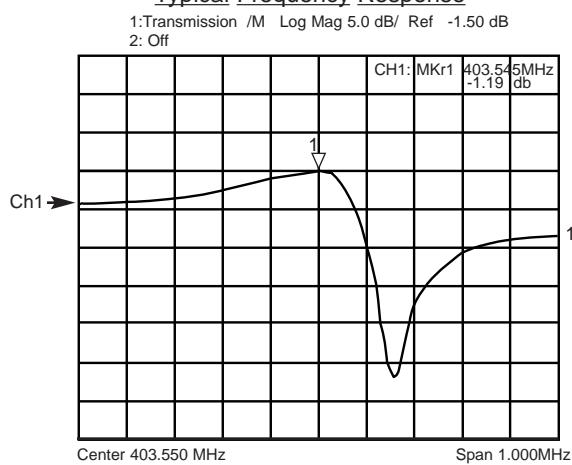
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency	MHz	403.475	403.55	403.625
Insertion loss	dB	-	2.0	2.5
Shunt capacitance	pF	-	1.8	-
Motional resistance	W	-	23	28
Motional inductance	mH	-	77.6154	-
Motional capacitance	fF	-	2.0040	-
Turnover temperature	°C	25	40	55
Temperature coefficient	ppm/C ²	-	0.037	-

Pin No.	Function
2	Input /Output
6	Output /Input
4, 8	Case GND
1, 3, 5, 7	N/C

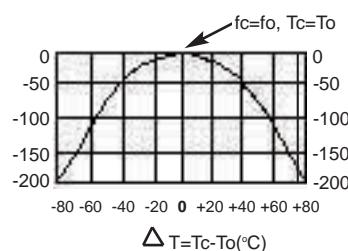
Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

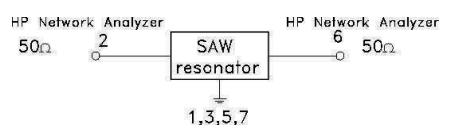
Typical Frequency Response



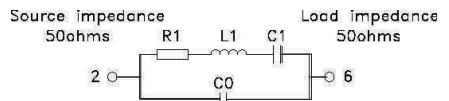
Temperature Characteristics



Test circuit:



Equivalent circuit:



Marking:

403.55

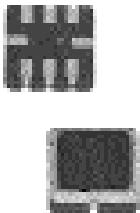
AZY

(ZY: Date code)

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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5.0 x 5.0 x 1.35mm

CERAMIC SURFACE-MOUNT, TWO-PORT SAW RESONATORS ASQ433.92E

FEATURES:

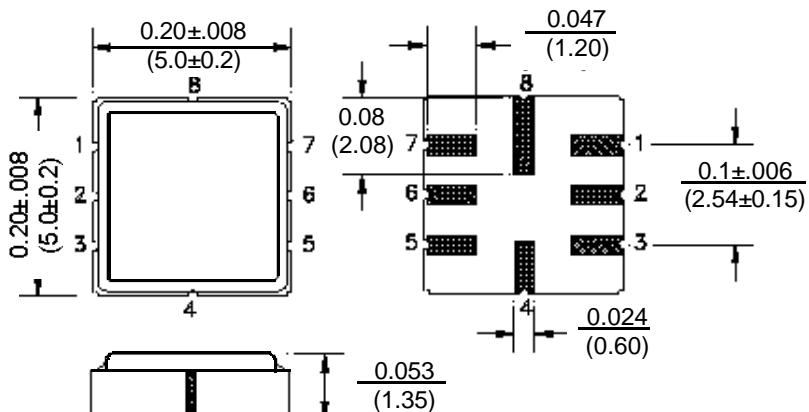
- Two-port SAW resonator 433.92MHz. See page 87- 88 for additional frequencies.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30V$
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +85°C
Maximum power dissipation	10dBm



Dimensions: Inches (mm)

STANDARD SPECIFICATIONS

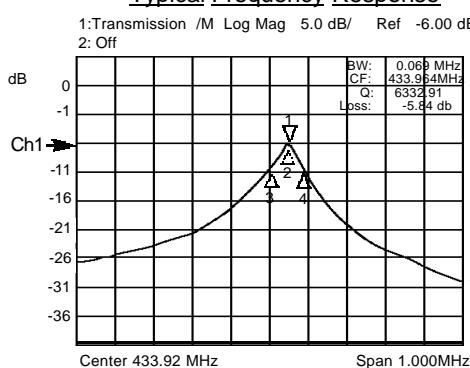
CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	433.820	433.920	434.020
Insertion loss	dB	-	6.0	8.0
Unloaded quality factor	Q	-	13,000	-
Loaded quality factor	LQ	-	6,500	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	1.9	2.2	2.5
Motional resistance	Ω	-	100	151
Motional inductance	μH	-	477.061	-
Motional capacitance	fF	-	0.2823	-
Turn-over temperature	°C	25	40	55
Temperature coefficient	ppm/ $^{\circ}C$	-	0.037	-

Pin No.	Function
2	Input /Output
6	Output /Input
4, 8	Case GND
1, 3, 5, 7	N/C

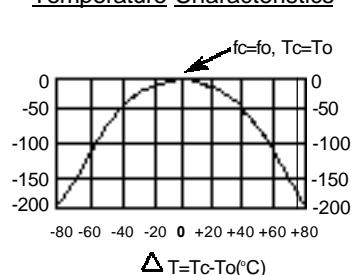
Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

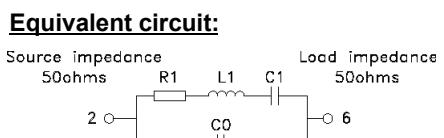
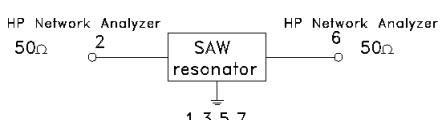
Typical Frequency Response



Temperature Characteristics



Test circuit:



Marking:

433.92
AZY

(ZY: Date code)

NOTE: Left blank if standard • All specifications and markings subject to change without notice

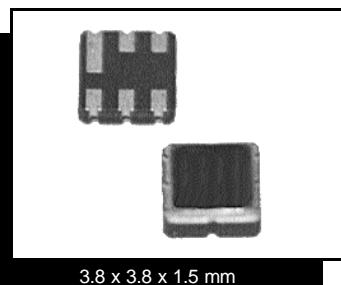
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CERAMIC SURFACE-MOUNT, TWO-PORT

SAW RESONATORS

ASQ915S3



FEATURES:

- Two-port SAW resonator 915MHz. See page 87- 88 for additional frequencies.
- SMD makes reflow soldering possible.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	12V		
Operating temperature	-30°C to +85°C		
Storage temperature	-40°C to +85°C		
Maximum power dissipation	0dBm		

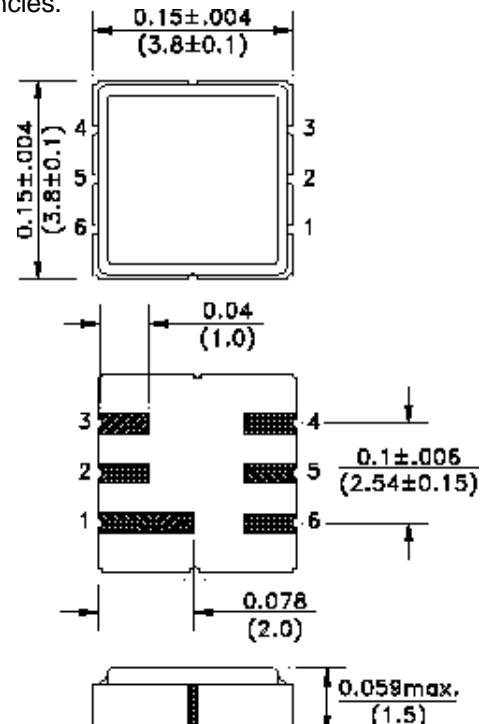
STANDARD SPECIFICATIONS

PART NUMBER	ASQ915S3			
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency	Fr	MHz	914.85	915
Insertion loss	IL	dB	-	8
Shunt capacitance	Co	pF	-	1.9
Motional resistance	R1	Ω	-	12.5
Motional inductance	L1	μH	-	134.5
Motional capacitance	C1	fF	-	0.225
Turnover temperature	To	°C	-	25
Temperature coefficient	TC	ppm/C ²	-	0.032

Packaging option: -T for tape and reel, see appendix H.

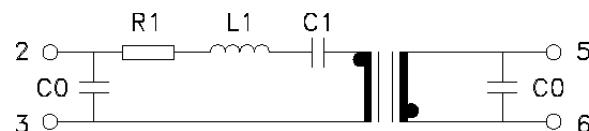
Reflow profile, see appendix E.

Reliability specifications, see SAW application notes.



Pin No.	Function
2	Input
5	Output
1, 3,	GND
4, 6	

Equivalent circuit:

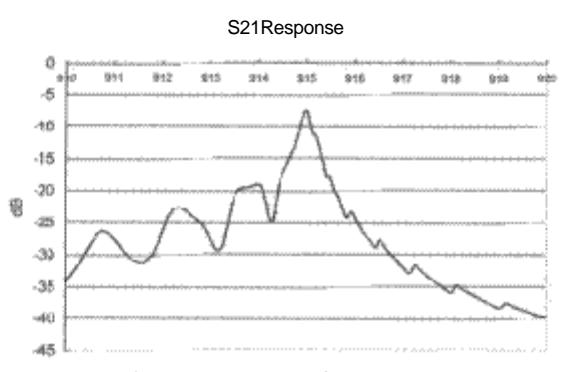


Marking:

915S3

AZY

(ZY: Date code)



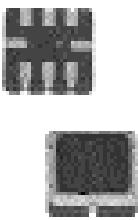
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5.0 x 5.0 x 1.7 mm

CERAMIC SURFACE-MOUNT RF SAW FILTERS AFS433E

FEATURES:

- RF filter 433.92MHz. See page 87- 88 for additional frequencies.
- Miniature and light weight.
- SMD makes reflow soldering possible.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	12V		
Operating temperature	-40°C to +85°C		
Storage temperature	-40°C to +85°C		
Maximum power dissipation	10dBm		

STANDARD SPECIFICATIONS

Characteristics	Unit	Conditions	Specifications	Note
Center frequency	F _c	MHz	433.92	1
Insertion loss	I _L	dB	Minimum	5.0 max.
3dB bandwidth	BW ₃	KHz	3dB	500 min. ~ 750 max.
Pass band	dB		433.76 ~ 434.08MHz	2.0 max.
	dB		433.74 ~ 434.10MHz	3.0 max.
	dB		433.68 ~ 434.16MHz	6.0 max.
Stopband attenuation	dB		414 ~ 428MHz	40 min.
	dB		428MHz ~ 432.84MHz	15 min.
	dB		434.92 ~ 442MHz	10 min.
	dB		442 ~ 550MHz	33 min..
Impedance at F _c	Z _{F_c}	Ω//pF	Input	212//3.1
			Output	212//3.1

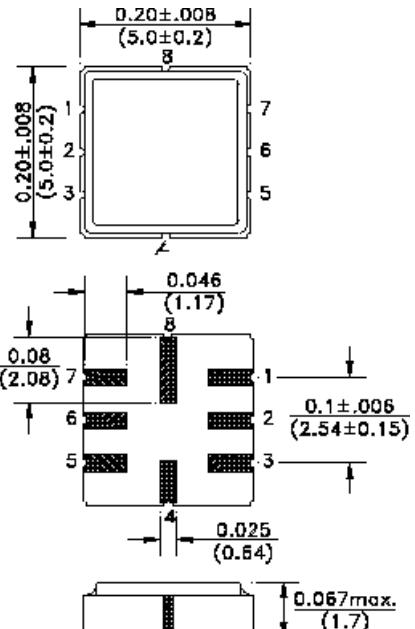
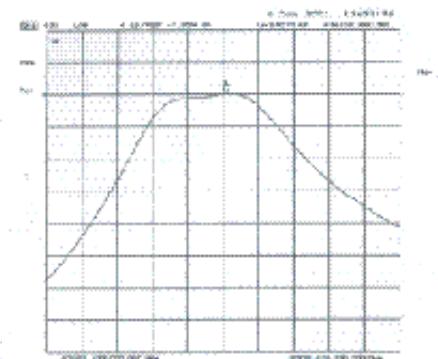
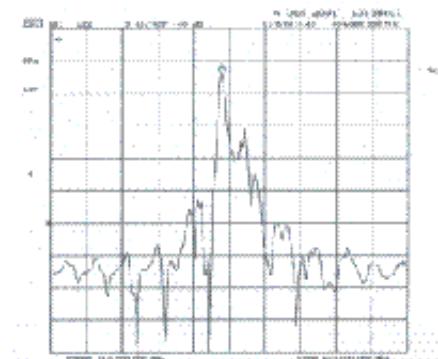
Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E.

Reliability specifications, see SAW application notes.

Start F = 410.00MHz Stop F = 460.00MHz

Start F = 433.00MHz Stop F = 435.00MHz



Pin No.	Function
1	Input GND
2	Input
5	Output
6	Output GND
4, 8	Case GND
3, 7	GND

Marking:

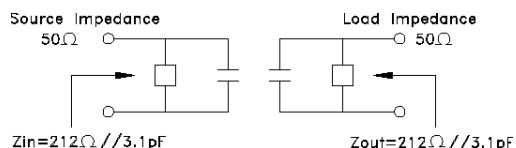
433E

AZY

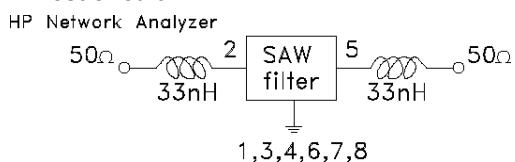
(ZY: Date code)

Note 1. The standard definitions is in JIS C 6703

Note 2.



Test circuit:



NOTE: Left blank if standard • All specifications and markings subject to change without notice

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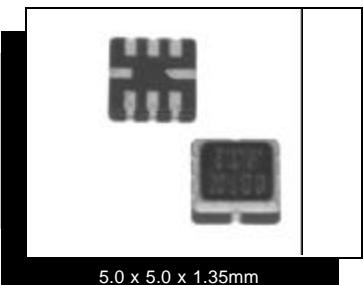
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CERAMIC SURFACE-MOUNT, ONE-PORT SAW RESONATORS

ASR433.42E



FEATURES:

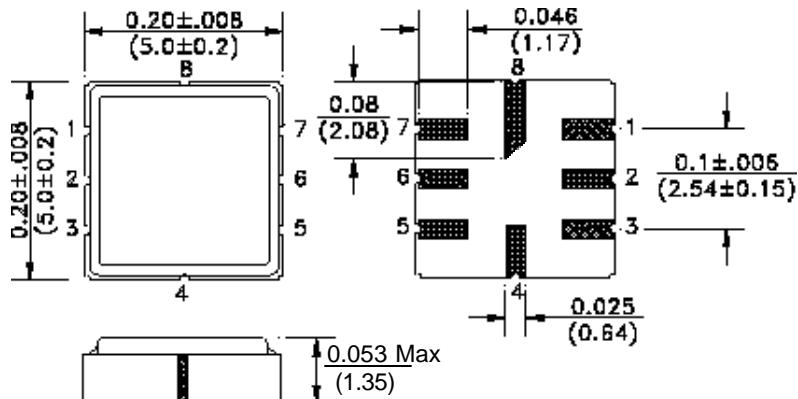
- One-port SAW resonator 433.42MHz.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 433.42 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

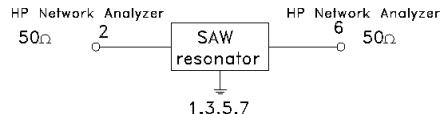
DC voltage	$\pm 30\text{Vdc}$
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm



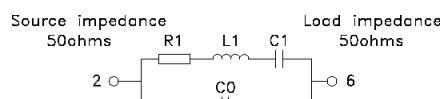
Dimensions: Inches (mm)

Pin No.	Function
2	Input/Output
6	Output/Input
4, 8 *	Case GND
1, 3, 5, 7	N/C

Test circuit:



Equivalent circuit:

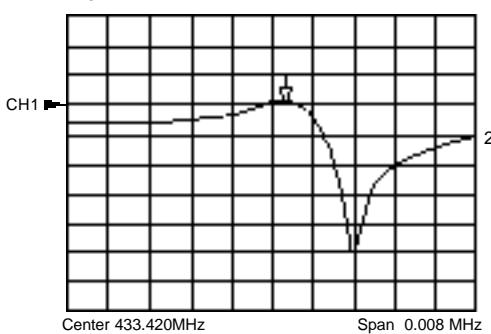


Packaging option: -T for tape and reel, see appendix H. Reflow profile, see appendix E.

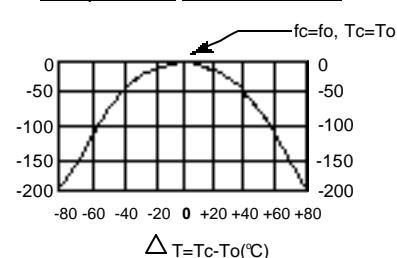
Reliability specifications, see SAW application notes.

Typical Frequency Response

1:Transmission /M Log Mag 5.8 dB/ Ref -1.52 dB
2: Off



Temperature Characteristics



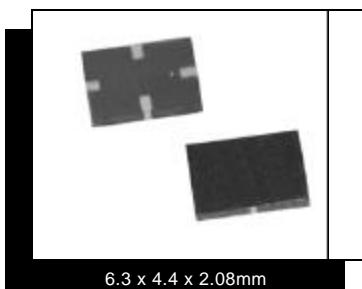
Marking:
ASR
433.42E

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CERAMIC SURFACE-MOUNT, ONE-PORT
SAW RESONATORS
ASR433.42S2

6.3 x 4.4 x 2.08mm

FEATURES:

- One-port SAW resonator 433.42 MHz, Fundamental mode.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 433.42 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30\text{Vdc}$
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

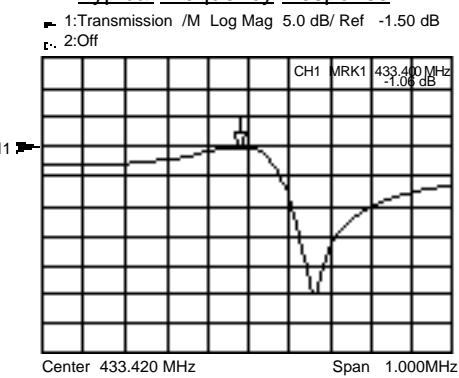
STANDARD SPECIFICATIONS

CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	433.345	433.420	433.495
Tolerance from 433.42MHz Δf_C	KHz	-	± 75	-
Insertion loss IL	dB	-	1.3	2.0
Unloaded quality factor Qu	-	-	10.500	-
Loaded quality factor 50Ω QL	-	-	1,250	-
Shunt capacitance Co	pF	-	2.6	-
Motional resistance R1	Ω	-	16	26
Motional inductance L1	μH	-	53.272	-
Motional capacitance C1	fF	-	2.5337	-
Turn-over temperature To	°C	25	40	55
Temperature coefficient Tc	ppm/ $^{\circ}\text{C}^2$	-	0.037	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	$\text{M}\Omega$	1.0	-	-

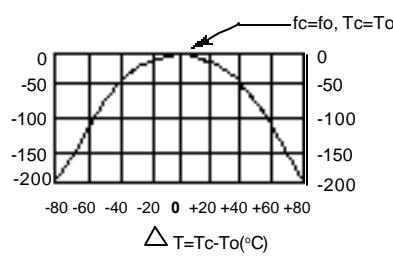
Packaging option: -T for tape and reel, see appendix H.

Reflow profile, see appendix E. Reliability specifications, see SAW application notes.

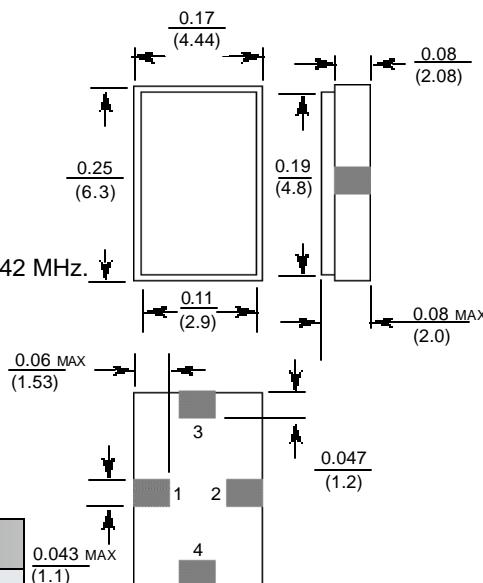
Typical Frequency Response



Temperature Characteristics

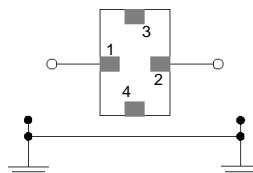


Dimensions: Inches (mm)

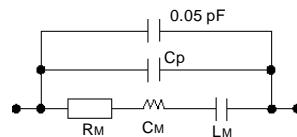


Pin No.	Function
1	Input/Output
2	Output/Input
3 & 4	Case GND

Test circuit:



Equivalent circuit:



Marking:
ASR
433.42S2

**CERAMIC SURFACE-MOUNT, ONE-PORT
SAW RESONATORS**
ASR433.92E

FEATURES:

- One-port SAW resonator 433.92 MHz. Fundamental mode.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 433.92 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABLSOLUTE MAXIMUM RATINGS:

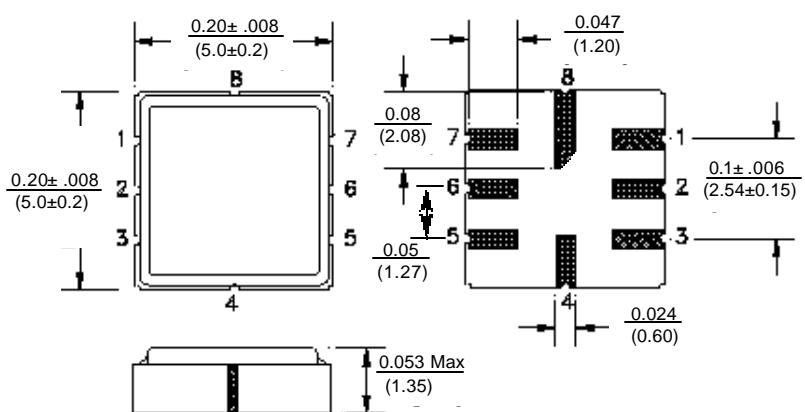
DC voltage	$\pm 30\text{Vdc}$
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

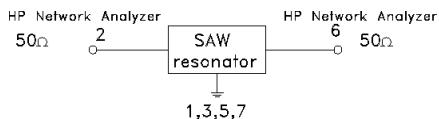
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	433.845	433.92	434.995
Tolerance from 433.92MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	1.3	2.0
Shunt capacitance Co	pF	-	2.2	-
Motional resistance R1	Ω	-	16	26
Motional inductance L1	μH	-	66.724	-
Motional capacitance C1	fF	-	2.1817	-
Turn-over temperature To	°C	25	40	55
Temperature coefficient Tc	ppm/C ²	-	0.037	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	$M\Omega$	1.0	-	-

Packaging option: -T for tape and reel, see appendix H.

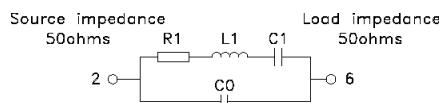
Reflow profile, see appendix E. Reliability specifications, see SAW application notes.



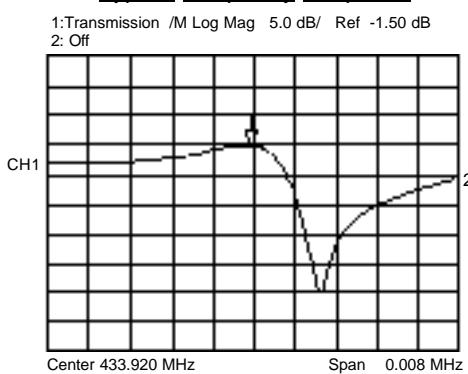
Test circuit:



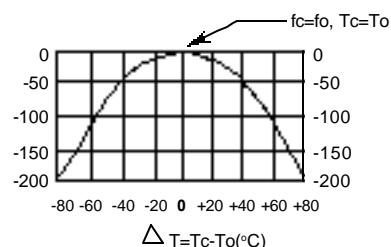
Equivalent circuit:



Typical Frequency Response



Temperature Characteristics



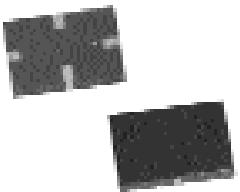
Marking:
ASR
433.92E

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6.3 x 4.4 x 2.08mm

CERAMIC SURFACE-MOUNT SAW RESONATORS ASR916.5S2

FEATURES:

- One-port SAW resonator 916.5MHz.
- Small ceramic surface-mount.
- SMD makes reflow soldering possible.
- Gold plated terminals.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 916.5MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

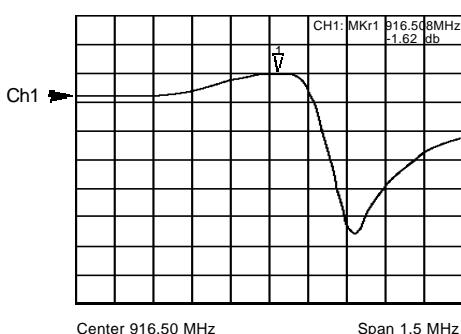
CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	916.405	916.5	916.595
Insertion loss	dB	-	2.5	-
Unloaded quality factor	Q	-	23,509	-
Loaded quality factor	LQ	-	4000	-
Aging per year	ppm	-	-	50
Shunt capacitance	pF	-	2.2	-
Motional resistance	Ω	-	20.5036	-
Motional inductance	μH	-	83.704	-
Motional capacitance	fF	-	0.3603	-
Turn-over temperature	°C	10	25	40
Temperature coefficient	ppm/ $^{\circ}C$	-	0.032	-

Packaging option: -T for tape and reel, see appendix H.

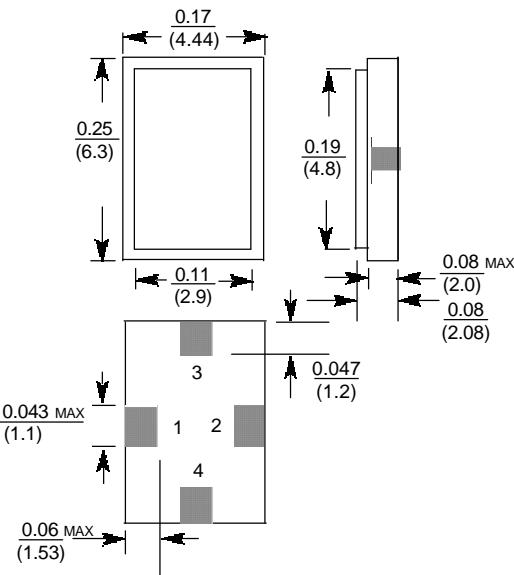
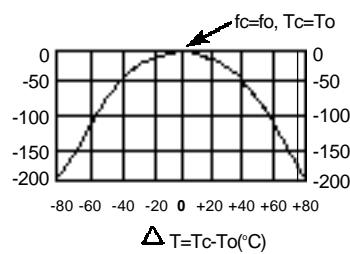
Reflow profile, see appendix E. Reliability specifications, Environmental and mechanical specifications, see page 91 in the Abracon Catalog

Typical Frequency Response

1:Transmission /M Log Mag 5.0 dB/ Ref -1.50 dB
2: Off



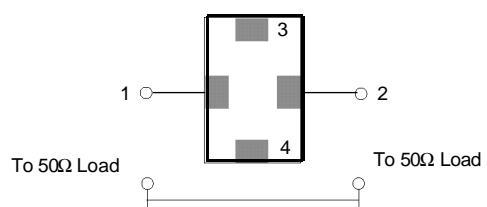
Temperature Characteristics



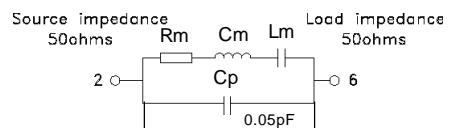
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3 & 4	Case GND

Test circuit:



Equivalent circuit:



Marking:

916.5
AZY
(ZY: Date code)

NOTE: All specifications and markings subject to change without notice

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**LEADED, TO-39 PACKAGE
SAW RESONATORS
ASR310**



FEATURES:

- One-port SAW resonator 310MHz. See page 87- 88 for additional frequencies.
- Wide operating temperature range.

APPLICATIONS:

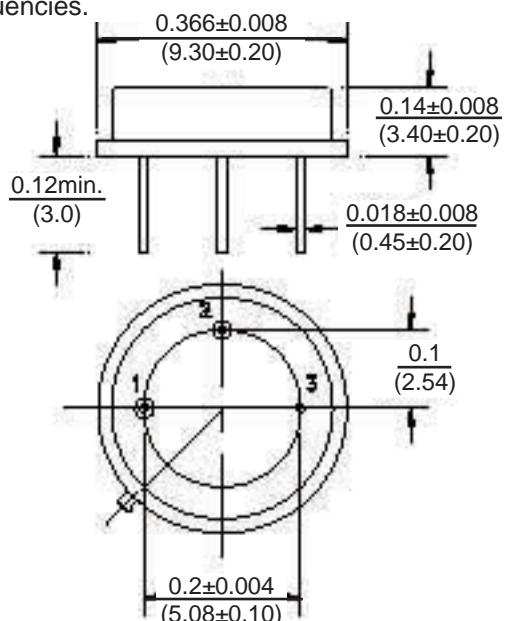
- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30V$		
Operating temperature	-40°C to $+85^{\circ}\text{C}$		
Storage temperature	-40°C to $+85^{\circ}\text{C}$		
Maximum power dissipation	10dBm		

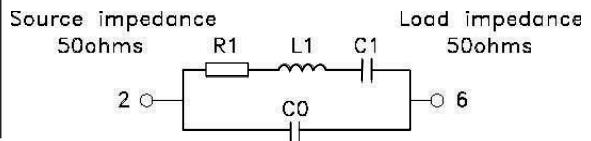
STANDARD SPECIFICATIONS

CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	309.925	310.000	310.075
Insertion loss	dB	-	1.3	2.0
Unloaded quality factor	Q	-	15333	-
loaded quality factor	LQ	-	2,000	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	1.8	2.1	2.4
Motional resistance	W	-	15	24
Motional inductance	mH	-	118.143	-
Motional capacitance	fF	-	2.2333	-
Turn-over temperature	$^{\circ}\text{C}$	25	40	55
Temperature coefficient	ppm/ $^{\circ}\text{C}^2$	-	0.037	-



Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

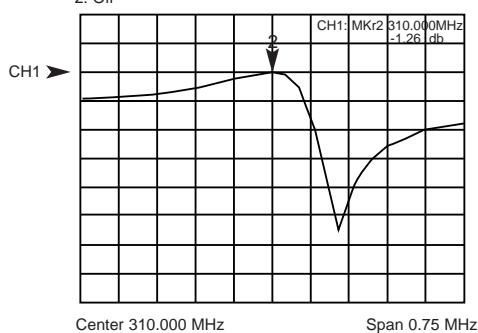
Equivalent circuit:



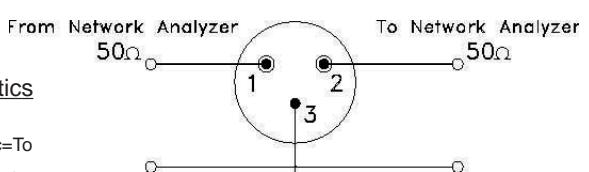
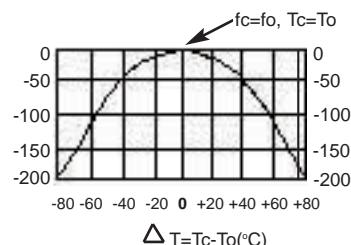
Reliability specifications, see SAW application notes.

Typical Frequency Response

1:Transmission /M Log Mag 5.0 dB/ Ref -1.50 dB
2: Off



Temperature Characteristics



Marking:
310
AZY
(ZY: Date code)

NOTE: Left blank if standard • All specifications and markings subject to change without notice

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SAW RESONATORS
ASR314.5



FEATURES:

- One-port SAW resonator 314.5 MHz. Fundamental mode.
- Wide operating temperature range.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 314.5 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

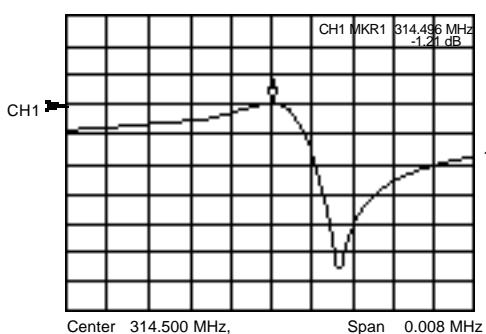
STANDARD SPECIFICATIONS

CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	314.425	314.5	314.575
Tolerance from 314.5 MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	1.5	2.0
Unloaded quality factor Q _U	-	-	12,500	-
loaded quality factor 50Ω Q _L	-	-	2,000	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	MΩ	1.0	-	-
Shunt capacitance C ₀	pF	-	2.25	-
Motional resistance R ₁	Ω	-	19	26
Motional inductance L ₁	μH	-	120.503	-
Motional capacitance C ₁	fF	-	2.1274	-
Turnover temperature To	°C	25	40	55
Temperature coefficient T _c	ppm/C ²	-	0.037	-

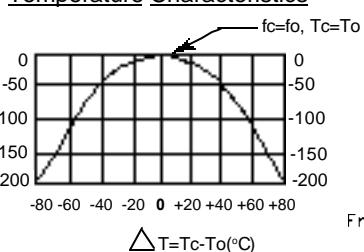
Reliability specifications, See SAW application notes

Typical Frequency Response

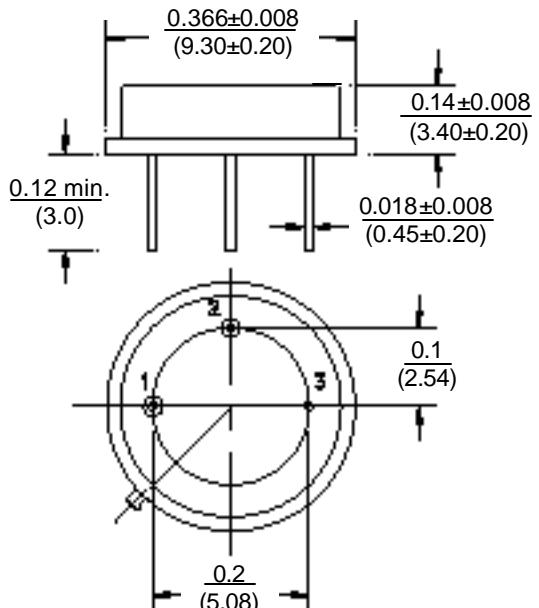
► 1:Transmission /M Log Mag 5.0 dB/ Ref -1.50 dB
 ▲ 2: Off



Temperature Characteristics



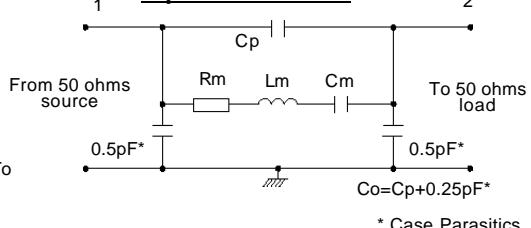
Marking:
 ASR
 314.5



Dimensions: Inches (mm)

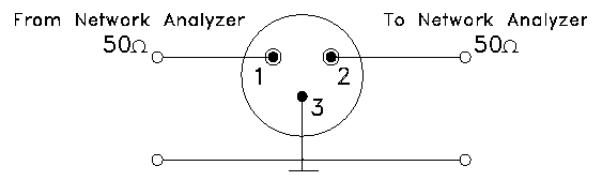
Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:



* Case Parasitics

Test circuit:





9.8 x 9.8 x 3.6 mm

LEADED, TO-39 PACKAGE, ONE-PORT

SAW RESONATORS

ASR315

FEATURES:

- One-port SAW resonator 315 MHz. Fundamental mode.
- Wide operating temperature range.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 315.00 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

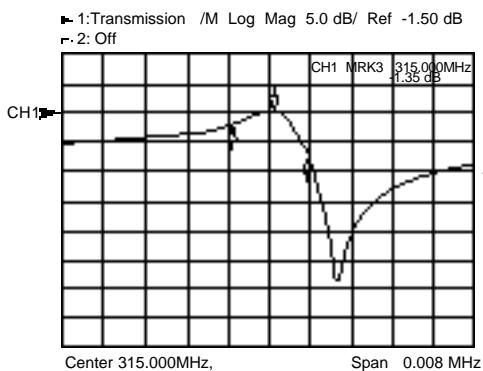
DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

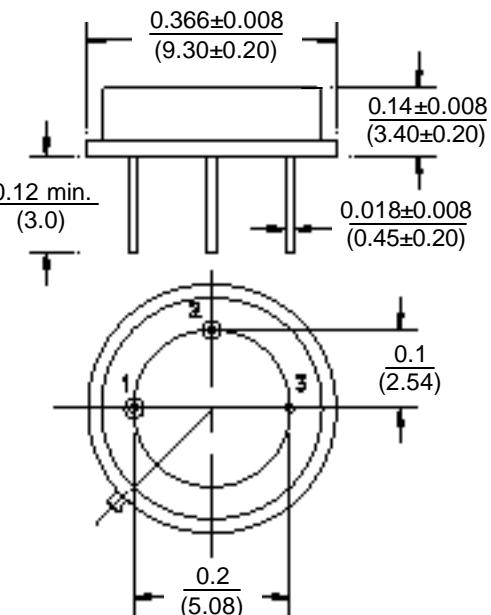
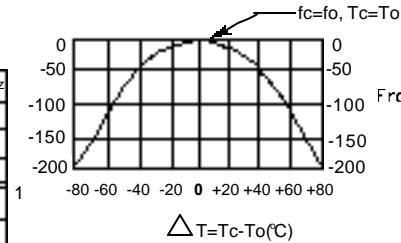
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	314.925	315.000	315.075
Tolerance from 315 MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	1.5	2.2
Unloaded quality factor Qu	-	-	12.500	-
Loaded quality factor 50Ω QL	-	-	2,000	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	$M\Omega$	1.0	-	-
Shunt capacitance Co	pF	-	2.0	-
Motional resistance R1	Ω	-	19	29
Motional inductance L1	μH	-	120.311	-
Motional capacitance C1	fF	-	2.1240	-
Turnover temperature To	°C	25	40	55
Temperature coefficient Tc	ppm/ C^2	-	0.037	-

Reliability specifications, see SAW application notes.

Typical Frequency Response



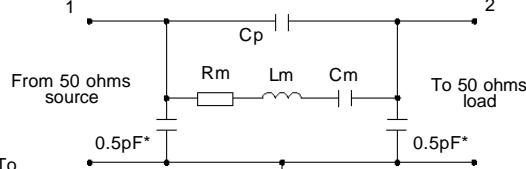
Temperature Characteristics



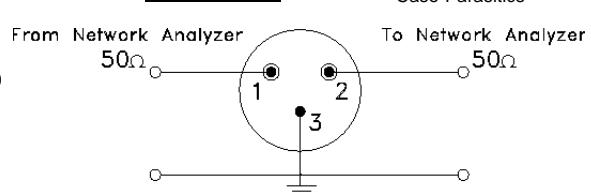
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:



Test circuit:



Marking:

ASR
315



S16

NOTE: All specifications and markings subject to change without notice

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**LEADED, TO-39 PACKAGE
SAW RESONATORS
ASR318**



FEATURES:

- One-port SAW resonator 318.0MHz. See page 87- 88 for additional frequencies.
- Wide operating temperature range.

APPLICATIONS:

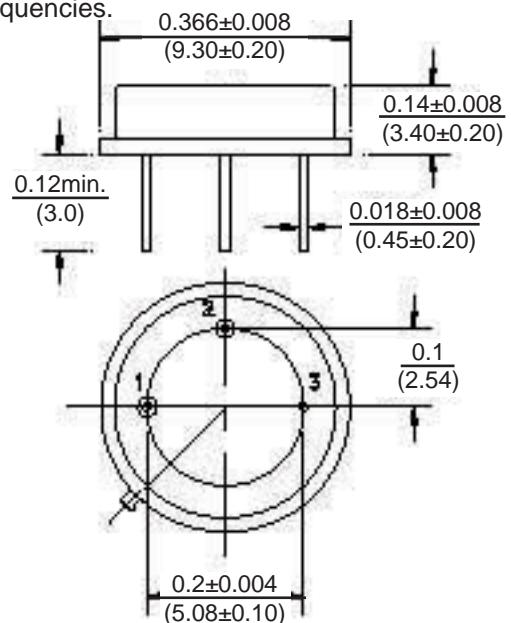
- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABLSOLUTE MAXIMUM RATINGS:

DC voltage	$\pm 30V$		
Operating temperature	$-40^{\circ}C$ to $+85^{\circ}C$		
Storage temperature	$-40^{\circ}C$ to $+85^{\circ}C$		
Maximum power dissipation	10dBm		

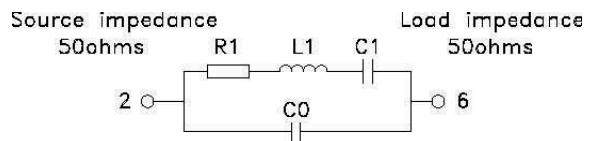
STANDARD SPECIFICATIONS

CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	317.925	318.000	318.075
Insertion loss	dB	-	1.5	2.0
Unloaded quality factor	Q	-	12,500	-
loaded quality factor	LQ	-	2000	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	2.3	2.6	2.9
Motional resistance	W	-	19	26
Motional inductance	mH	-	119.1764	-
Motional capacitance	fF	-	2.1040	-
Turn-over temperature	$^{\circ}C$	25	40	55
Temperature coefficient	ppm/ C^2	-	0.037	-



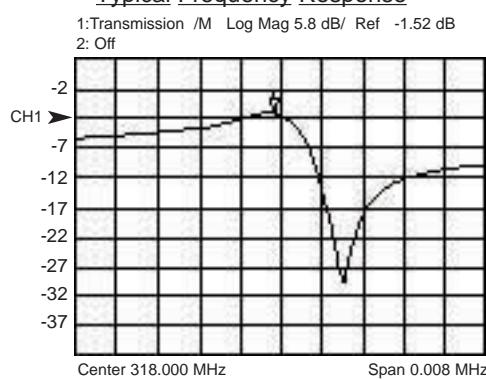
Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:

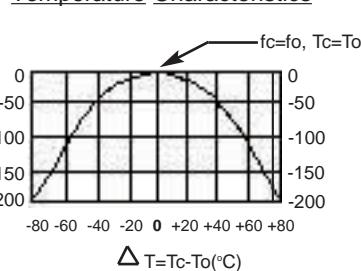


Reliability specifications, see SAW application notes.

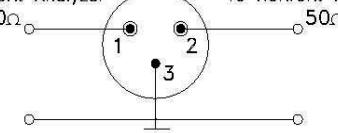
Typical Frequency Response



Temperature Characteristics



Test circuit:



Marking:

318

AZY

(ZY: Date code)

LEADED, TO-39 PACKAGE

SAW RESONATORS

ASR418



9.8 x 9.8 x 3.6 mm

FEATURES:

- One-port SAW resonator 418MHz. See page 87- 88 for additional frequencies.
- Wide operating temperature range.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABSOLUTE MAXIMUM RATINGS:

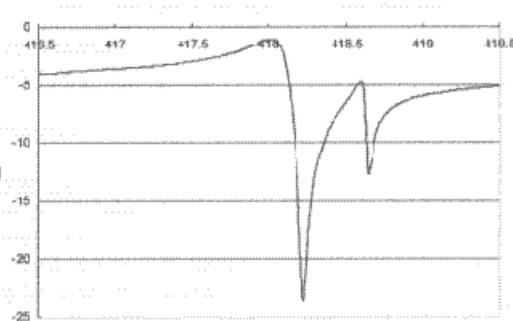
DC voltage	12V
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +85°C
Maximum power dissipation	0dBm

STANDARD SPECIFICATIONS

CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	417.925	418	418.075
Insertion loss	dB	-	1.5	2.5
Unloaded quality factor	Q	-	6000	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	-	4.14	-
Motional resistance	Ω	-	14	-
Motional inductance	μH	-	55.07	-
Motional capacitance	fF	-	2.63	-
Turn-over temperature	°C	-	25	-
Temperature coefficient	ppm/ C^2	-	0.032	-

Reliability specifications, see SAW application notes.

S21Response for 418MHz one-port Resonator



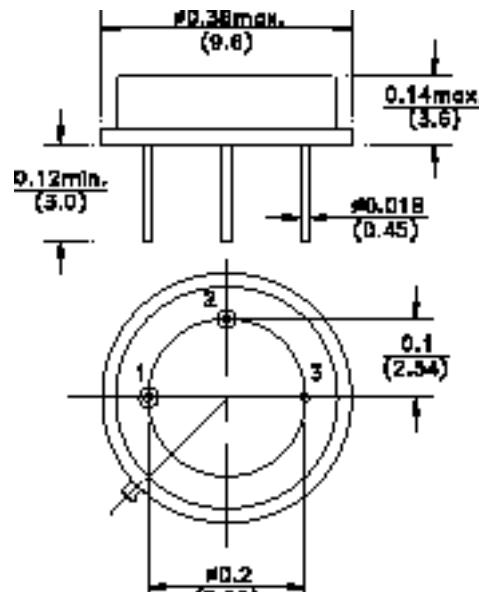
Center Freq=418MHz, Span=3MHz

Marking:

418

AZY

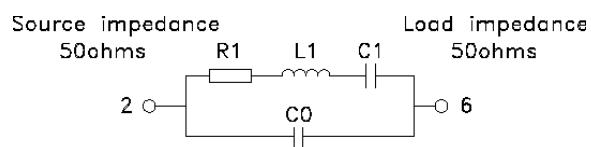
(ZY: Date code)



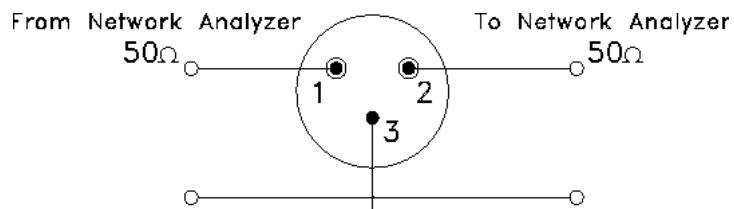
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3	GND

Equivalent circuit:



Test circuit:



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NOTE: Left blank if standard • All specifications and markings subject to change without notice

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ABRACON
CORPORATION

**LEADED, TO-39 PACKAGE
SAW RESONATORS
ASR418A**



FEATURES:

- One-port SAW resonator 418 MHz. Fundamental mode.
- Wide operating temperature range.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 418.00 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

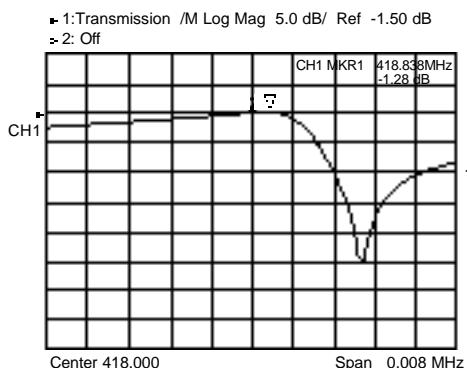
DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

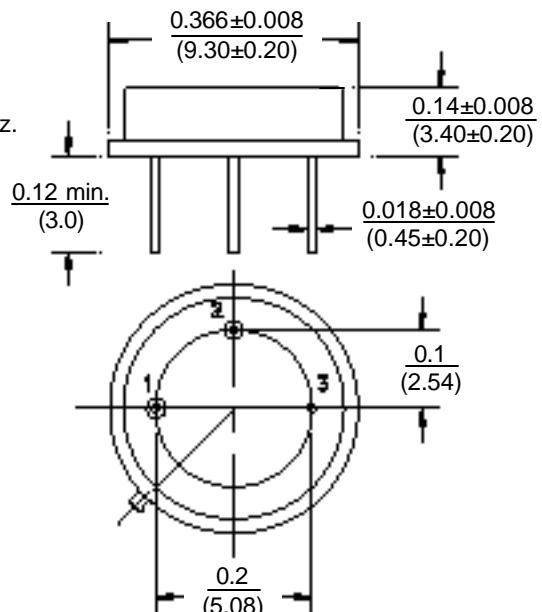
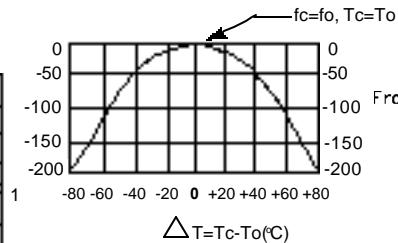
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	417.925	418.00	418.075
Tolerance from 418 MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	1.5	2.2
Unloaded quality factor Q _U	-	-	12.500	-
loaded quality factor 50Ω Q _L	-	-	2000	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	MΩ	1.0	-	-
Shunt capacitance C _O	pF	-	1.8	-
Motional resistance R ₁	Ω	-	19	29
Motional inductance L ₁	μH	-	90.665	-
Motional capacitance C ₁	fF	-	1.6006	-
Turnover temperature T _O	°C	25	40	55
Temperature coefficient T _C	ppm/C ²	-	0.037	-

Reliability specifications, see SAW application notes.

Typical Frequency Response



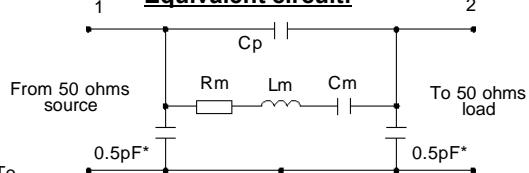
Temperature Characteristics



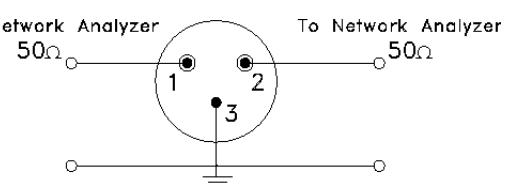
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:



Test circuit:



Marking:

ASR
418A

LEADED, TO-39 PACKAGE, ONE-PORT

SAW RESONATORS

ASR433.42

FEATURES:

- One-port SAW resonator 433.42 MHz. Fundamental mode.
- Wide operating temperature range.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 433.42 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

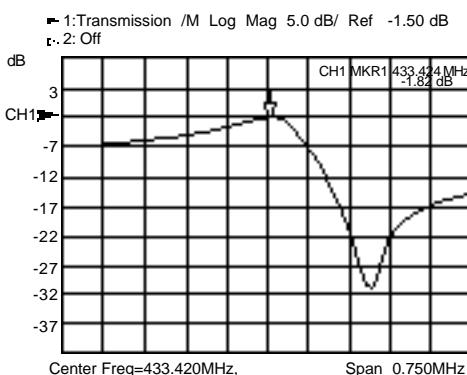
DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

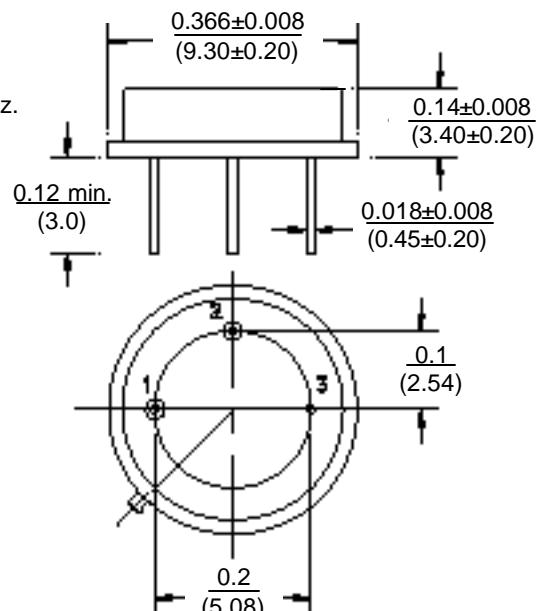
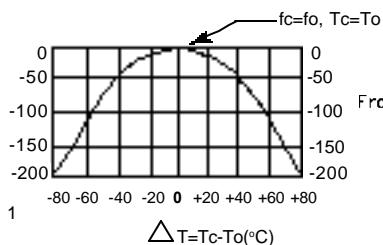
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	433.345	433.420	433.495
Tolerance from 433.42MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	2.0	2.5
Unloaded quality factor Q	-	-	10.600	-
loaded quality factor 50Ω Q	-	-	2,200	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	MΩ	1.0	-	-
Shunt capacitance Co	pF	-	2.1	-
Motional resistance R1	Ω	-	26	33
Motional inductance L1	μH	-	101.841	-
Motional capacitance C1	fF	-	1.3254	-
Turnover temperature To	°C	25	40	55
Temperature coefficient Tc	ppm/C ²	-	0.037	-

Reliability specifications, see SAW application notes.

Typical Frequency Response



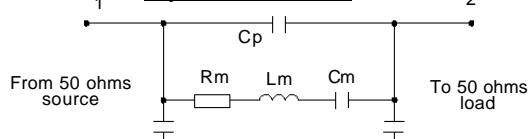
Temperature Characteristics



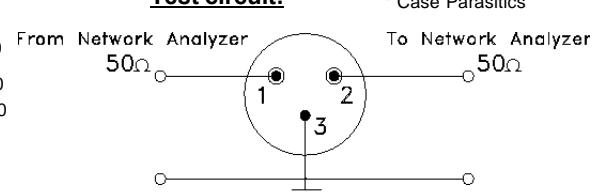
Dimensions: Inches (mm)

Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:



Test circuit:



Marking:

ASR
433.42



9.8 x 9.8 x 3.6 mm

LEADED, TO-39 PACKAGE, ONE-PORT SAW RESONATORS **ASR433T**

FEATURES:

- One-port SAW resonator 433.92 MHz. Fundamental mode.
- Wide operating temperature range.

COMMON APPLICATIONS:

- Quartz frequency stabilization of fixed-frequency transmitters at 433.92 MHz.
- Wireless car alarm, Garage door opener. (RKE)
- Mobile communications systems

ABSOLUTE MAXIMUM RATINGS:

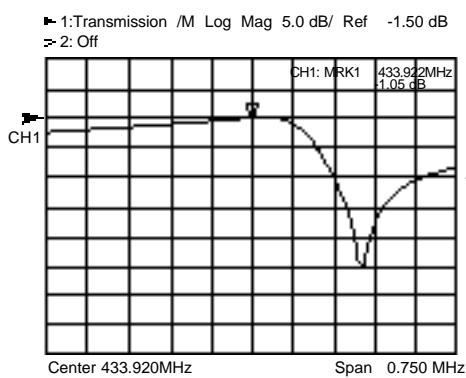
DC voltage	± 30 Vdc
Operating temperature	-40°C to +85°C
Maximum power dissipation	10dBm

STANDARD SPECIFICATIONS

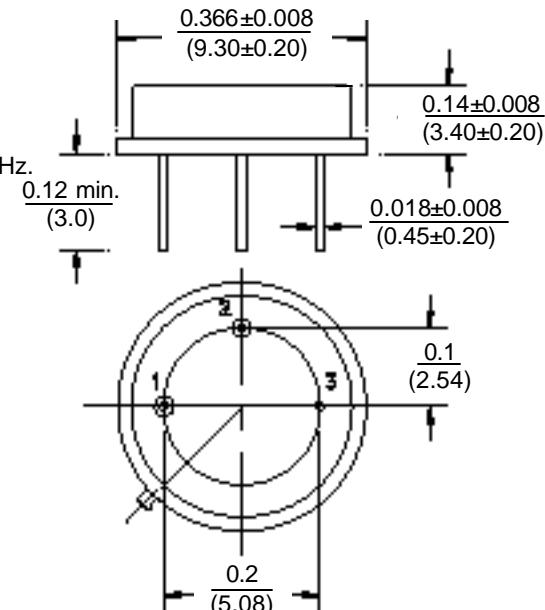
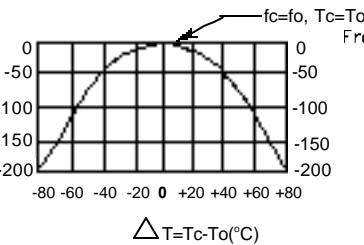
CHARACTERISTICS	UNIT	min.	typ.	max.
Center frequency Fr	MHz	433.845	433.920	434.995
Tolerance from 433.92MHz Δf_C	kHz	-	± 75	-
Insertion loss IL	dB	-	1.3	2.0
Unloaded quality factor Qu	-	-	10.500	-
Loaded quality factor 50Ω QL	-	-	1,450	-
Aging absolute first year [A]	ppm	-	-	10
DC insulation resistance	$M\Omega$	1.0	-	-
Shunt capacitance Co	pF	-	2.2	-
Motional resistance R1	Ω	-	16	26
Motional inductance L1	μH	-	61.724	-
Motional capacitance C1	fF	-	2.1817	-
Turnover temperature To	°C	25	40	55
Temperature coefficient Tc	ppm/ C^2	-	0.037	-

Reliability specifications, see SAW application notes.

Typical Frequency Response

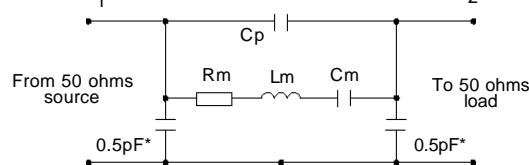


Temperature Characteristics

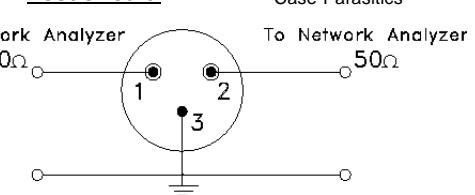


Pin No.	Function
1	Input/Output
2	Output/Input
3	Case GND

Equivalent circuit:



Test circuit:



Marking:

ASR
433T

LEADED, TO-39 PACKAGE
SAW RESONATORS
ASQ433.92



FEATURES:

- Two-port SAW resonator 433.92MHz. See page 87- 88 for additional frequencies.
- Wide operating temperature range.

APPLICATIONS:

- Wireless car alarm, Garage door opener.
- Remote keyless entry.

ABLSOLUTE MAXIMUM RATINGS:

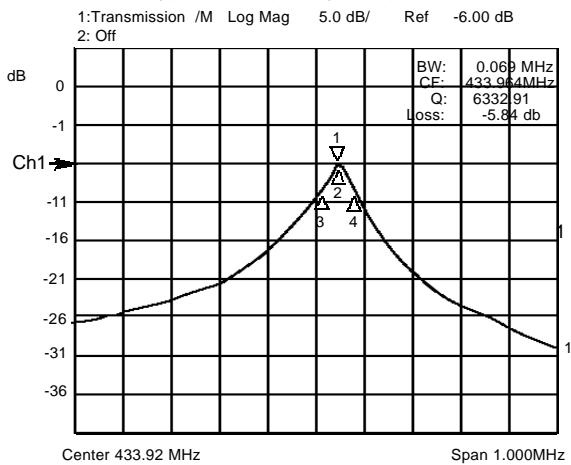
DC voltage	$\pm 30V$		
Operating temperature	$-40^{\circ}C$ to $+85^{\circ}C$		
Storage temperature	$-40^{\circ}C$ to $+85^{\circ}C$		
Maximum power dissipation	10dBm		

STANDARD SPECIFICATIONS

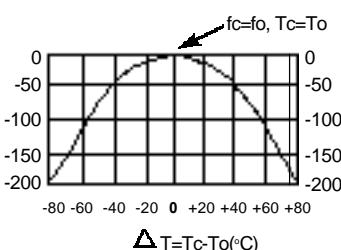
CHARACTERISTIC	UNIT	min.	typ.	max.
Center frequency	MHz	433.845	433.920	433.995
Insertion loss	dB	-	6.0	8.0
Unloaded quality factor	Q	-	13,000	-
Loaded quality factor	LQ	-	6,500	-
Aging per year	ppm	-	-	10
Shunt capacitance	pF	-	1.7	2.0
Motional resistance	Ω	-	100	151
Motional inductance	μH	-	477.061	-
Motional capacitance	fF	-	0.2823	-
Turn-over temperature	$^{\circ}C$	25	40	55
Temperature coefficient	ppm/ $^{\circ}C^2$	-	0.037	-

Reliability specifications, see SAW application notes.

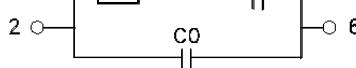
Typical Frequency Response



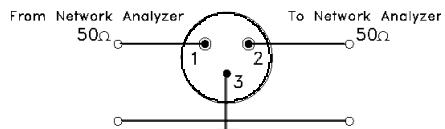
Temperature Characteristics



Source impedance 50ohms Load impedance 50ohms



Test circuit:



Marking:
 ASQ
 433.92

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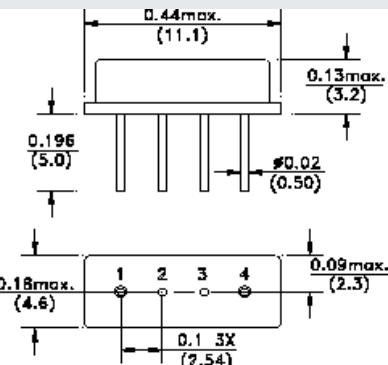
NOTE: Left blank if standard • All specifications and markings subject to change without notice

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ABRACON

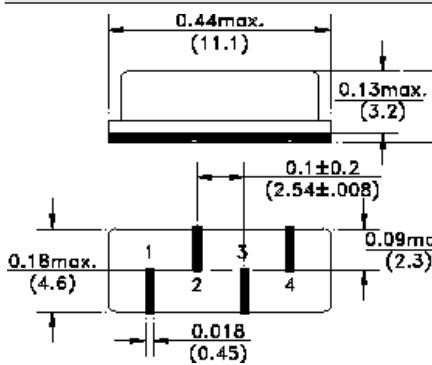
 CORPORATION

STANDARD SAW PACKAGES



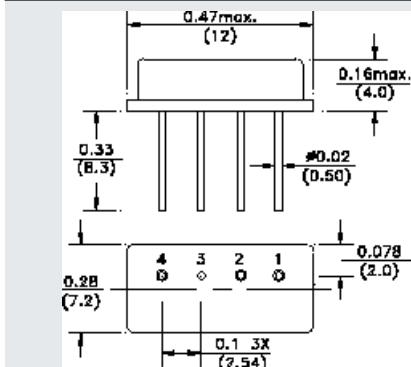
F-11

PIN #	FUNCTION
1	Output/Input
2	GND
3	GND
4	Input/Output



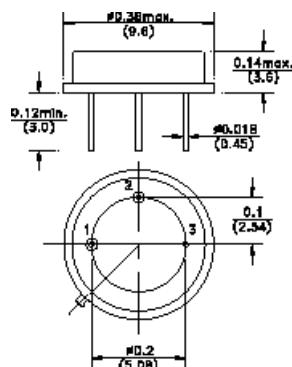
F-11SMD

PIN #	FUNCTION
1	Output/Input
2	GND
3	GND
4	Input/Output



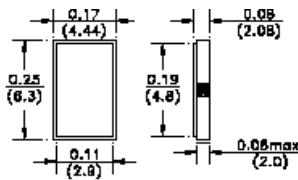
F-16

PIN #	FUNCTION
1	Output/Input
2	Input/Output
3	GND
4	Common



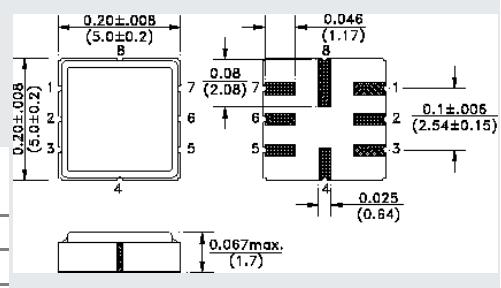
TO-39

PIN #	FUNCTION
1	Input/Output
2	Output/Input
3	GND



SM-2

PIN #	FUNCTION
1	Output/Input
2	Input/Output
3	GND
4	GND

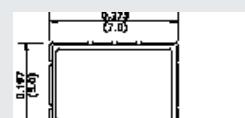


**E
SMD 5 x 5mm**

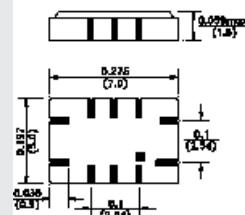
PIN #	FUNCTION
2	Input
6	Output
4, 8	Case GND
1, 3, 5, 7	GND

**S3
SMD 3.8 x 3.8mm**

PIN #	FUNCTION
2	Input
5	Output
1, 3	GND
4, 6	GND



**S1
SMD 7.0 x 5.0mm**



Dimensions: Inches (mm)



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SAW DEVICES DEVELOPED FREQUENCIES

ABRACON SERIES OF SAW RESONATOR (ONE-PORT RESONATOR)

Center Frequency (MHz)	Part number	Package Style	Applications
61.24/67.24 NTSC System	ASR61/67	F-16	Satellite Program Receiver, RF modulator
77.24/85.24 PAL System	ASR77/85	F-16	Satellite Program Receiver, RF modulator
91.24/97.24 Japan System	ASSR91/97	F-16	Satellite Program Receiver, RF modulator
117.200	ASR117	F-16	RF Modulator
211.000	ASR211	F-16	RF Modulator
260.000	ASR260	TO-39	Wireless Car Alarm, Keyless Entry, Garage door Opener
303.825	ASR303	TO-39,F-11,F-11 SMD, SM-2	
303.875	ASR303K	TO-39,F-11,F-11 SMD, SMD5x5	
304.300	ASR304	TO-39,F-11, SM-2	
310.000	ASR310	TO-39,F-11,F-12	
314.500	ASR314.5	TO-39,F-11,F-11SMD, SMD5x5, SM-2	
315.000,	ASR315	TO-39,F-11,F-11SMD, SMD5x5, SM-2	
316.800	ASR316.8	TO-39	
318.000	ASR318	TO-39,F-11, SM-2	
360.000	ASR360	TO-39	
396.000	ASR396	TO-39	
407.300	ASR407	TO-39	
423.220	ASR423	TO-39, SM-2	
433.420	ASR433.42	TO-39,F-11, SMD5x5, SM-2	
433.875	ASR433.875	TO-39,SMD	
433.920	ASR433, ASR433A, ASR433T	TO-39,F-11,F-11SMD, SMD5x5,SM-2	Wireless Application
436.000	ASR436, ASR436J		
857.650	ASR857.65	TO-39	
868.300	ASR868.3	TO-39,F-11,F-11 SMD, SMD5x5	
868.350	ASR868.35	TO-39,F-11,F-11 SMD, SMD5x5	
912.000	ASR912	TO-39,F-11	
925.000	ASR925	TO-39, SMD5x5	
960.000	ASR960	F-11	

ABRACON SERIES OF SAW RESONATOR (TWO-PORT RESONATOR)

Center Frequency (MHz)	Part number	Package Style	Application
303.825	ASQ303	TO-39	Wireless Control & Alarm
304.300	ASQ304	TO-39,F-11	
315.000	ASQ315	TO-39,F-11,F-11 SMD	
380.000	ASQ380	TO-39	
384.000	ASQ384	TO-39	
403.550	ASQ403.55	TO-39	
423.220	ASQ423	TO-39	
433.420	ASQ433.420	TO-39	
433.920	ASQ433.920	TO-39,F-11,F-11 SMD	
515.000	ASQ515	F-11	
868.300	ASQ868.3	TO-39,F-11,F-11 SMD, SMD5x5	
912.000	ASQ912	TO-39	

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SAW DEVICES DEVELOPED FREQUENCIES

ABRACON SERIES OF SAW RESONATOR (1-PORT) FOR CATV APPLICATION

Center Frequency (MHz)	Part number	Package Style	Application
49.75,57.75,65.75,77.25,etc.	AR1-12P,1-12PZ,1-24PB,1-12ZB	F-16	1-24 Channel (PAL System)

ABRACON SERIES OF SAW RESONATOR (1-PORT) FOR CATV SYSTEM FM BROADCASTING

Center Frequency (MHz)	Part number	Package Style	Application
98.700-118.000	AR1-AR62	F-16	CATV System FM Broadcasting

ABRACON SERIES OF SAW FILTER

Center Frequency (MHz)	Part number	Description	Package Style	Application
110.000/110.590	AFS110L/NDF110N	IF Filter	F-11,F-11 SMD	IF Filter
139.000,147.000, 155.000	AFS139,AFS147,AFS155	Bandwidth+/-4MHz	F-11	BP Pager
163.000,171.00	AFS163,AFS171	Bandwidth+/-4MHz	F-11	BP Pager
173.225	AFS173.225	Narrow Band Filter	F-11	RF Module
280.000	AFS280	Wide & Narrow Band Filter	F-11	BP Pager
280.000	AFS377	Wide Band Filter (20.5MHz Bandwidth)	SMD5x5QCC8	Computer Wireless LAN Access Card
315.000	AFS315	Narrow Band Filter	TO-39,F-11	Front-end of Car Alarm Receiver
374.00	AFS474	Wide Band Filter (20.5MHz Bandwidth)	SMD5x5QCC8	Computer Wireless LAN Access Card
418.000	AFS418	Narrow Band Filter	TO-39	
433.920	AFS433	Narrow Band Filter	TO-39,F-11	Wireless Control & Alarms
479.5, 480.000	AFS480-1,-2,-3,-4,-5,-6, -7,-8	Wide Band Filter (18MHz, 27MHz,36MHz, 8MHz Bandwidth)	TO-39	Satellite Program Receiver DBS System
868.000	AFS868		F-11	
914.500	AFS914		F-11,F-11 SMD	BP Pager
939.000	AFS939		F-11	

ABRACON SERIES OF SAW RESONATOR & FILTER IN SMD5X5 (E) PACKAGE

Part number	Description	Part number	Description
ASR315E	315.00MHz 1-port resonator	ASQ868E	868.00MHz 2-port resonator
ASR403E	403.55MHz 1-port resonator	ASQ868.3E	868.30MHz 2-port resonator
ASR423E	423.22MHz 1-port resonator	ASR868.35E	868.35MHz 1-port resonator
ASR418E	418.00MHz 1-port resonator	ASR916E	916.5MHz 1-port resonator
ASR433.42E	433.42MHz 1-port resonator		
ASR433.92E	433.92MHz 1-port resonator		
ASR643E	643.75MHz 1-port resonator		
ASR868E	868.00MHz 1-port resonator		
ASR868.3E	868.30MHz 1-port resonator		
AFS280E	280MHz Filter	AFS439E	439.85MHz Filter
AFS281E	281B Filter	AFS444E	444.625MHz Filter
AFS315E	315MHz Filter	AFS930E	930.5MHz Filter
AFS374E	374MHz Filter	AFS903E	903/927MHz Filter
AFS418E	418MHz Filter	AFS927E	927/903MHz Filter
AFS422E	422.2MHz Filter		
AFS433.42E	433.42MHz Filter		
AFS433.92E	433.92MHz Filter		
AFS868.3E	868.30MHz Filter		
AFS868.35E	868.35MHz Filter		

ORDER FORM

Visit www.abracon.com for online ordering forms

CUSTOM SAW DEVICES

Please specify the following items when ordering SAW devices:

I. ELECTRICAL CHARACTERISTICS

SAW Filters	SAW Resonators
Center Frequency: _____ MHz	Center Frequency: _____ MHz
Pass Bandwidth: _____ dB ± _____ q MHz q kHz min.	Insertion Loss: _____ dB max.
Stop Bandwidth: _____ dB ± _____ q MHz q kHz min. _____ dB ± _____ q MHz q kHz min.	Unloaded Q: _____ min.
Pass band Ripple: _____ dB max.	Aging: _____ ppm max./year
Insertion Loss: _____ dB max.	Motional capacitance: _____ pF qmin. qmax. qtyp.
Guaranteed attenuation: _____ dB min. ± _____ q MHz q kHz min.	Motional inductance: _____ μH qmin. qmax. qtyp.
Group Delay: _____ us max. ± _____ kHz	Motional resistance: _____ Ω qmax. qtyp.
Terminating Impedance: _____ Ω // _____ pF	Shunt capacitance: _____ pF qmax. qtyp.
Operating temperature: _____ °C to _____ °C	Temperature coefficient: _____ ppm/c² qmax. qtyp.
	Turn-over temperature: _____ °C ± _____ °C
	Operating temperature: _____ °C to _____ °C

II. PACKAGE TYPES

Leaded q Dimensions: _____
SMD q Dimensions: _____

III. APPLICATIONS

Application: _____
EAU: _____ / month _____ / year
Quantity requested for quote: _____

IV. SPECIAL ENVIRONMENTAL CONDITIONS

Storage temperature: _____ °C to _____ °C

Vibration total amplitude: _____ mm

Frequency of vibration: _____ Hz to _____ Hz

Shock: _____

Others: _____

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APPLICATION NOTES

SAW DEVICES

Definition of SAW:

Surface Acoustic Wave (SAW) is a wave propagating along the surface of an elastic substrate. Frequency of SAW is:

$$F = \frac{V}{\lambda}$$

Where V is the velocity of SAW (~ 3,100m/s)

λ Is the IDT period.

Frequency range of SAW products is 10MHz to 3GHz.

SAW filters characteristics:

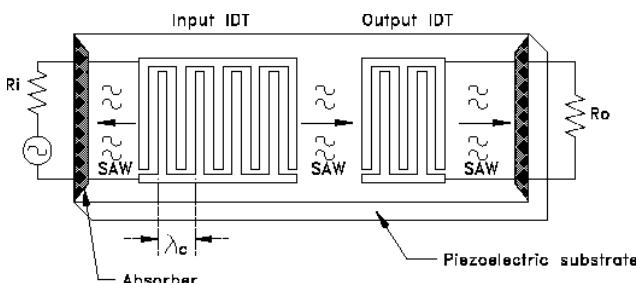
- u SAW filter is an integrated, passive device with bandpass filter characteristics.
- u Operation is based on the interference of mechanical surface waves.
- u Input/Output transducers are formed on a piezoelectric material.

SAW filters advantages:

- u Reduced size and weight.
- u High reliability and ruggedness.
- u No tuning or readjustment.
- u Mass production capable.

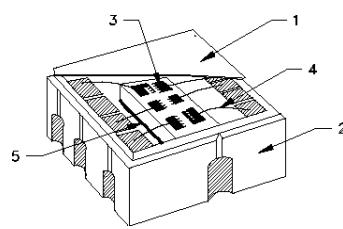
SAW filters fundamentals:

SAW devices consist of two transducers with interdigital transducers of thin metal electrodes deposited on a piezoelectric substrate such as quartz or lithium tantalite. One of these acts as the device input and converts signal voltage variations into mechanical surface acoustic waves. The other IDT is used as an output receiver to convert mechanical SAW vibrations back into output voltages. Such energy conversions require the Interdigital transducers to be used in conjunction with elastic surfaces that are also piezoelectric ones.



SAW devices structure:

No.	Parts list	Materials
1	Lid	FeNiCo
2	Ceramic base	Al2O3
3	Chip (Die)	LT, LN, SiO2
4	Wire	Al, Au
5	Bond	Ag. UV bond

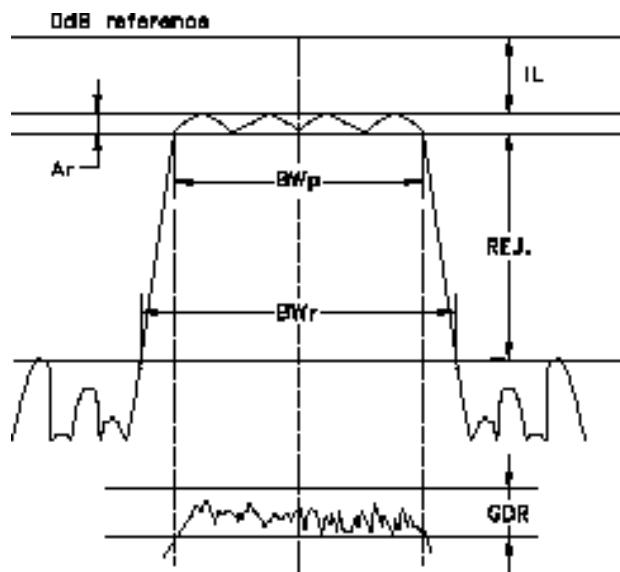


SAW filters manufacturing process:

- u Wafer (LiTaO₃ or LiNbO₃, or SiO₂)
- u Al deposit (sputtering) 0.15μ to 1.5μ
- u Photoresist (PR coating)
- u Exposure
- u Develop
- u Al etching (Wet etching)
- u PR removal
- u QC check + Probing (F0, IL)
- u Sieving (Scribing)
- u QC check (chips, cracks)
- u Mounting Ag/UV bond
- u Wire bonding
- u Seam sealing
- u Marking
- u Final tests and inspections

SAW filter parameters:

- f Nominal frequency F_n (MHz)
- f Pass Bandwidth 3dB BWP (MHz)
- f Stop Bandwidth BWr (MHz)
- f Insertion Loss IL (dB)
- f Pass Band Ripple AR (dB)
- f Group Delay GD (μs)
- f Temperature coefficient TC (ppm/K)
- f Termination Impedance (ohms)
- f Operating temperature range T (°C)



APPLICATION NOTES

SAW DEVICES

GLOSSARY OF TERMS

Nominal frequency (Fn): The nominal values of the center frequency F0 and is used as the reference frequency of related standard. Unit of nominal frequency is in MHz.

Insertion Loss (IL): The logarithmic ratio of the power delivered to the load impedance before the filter is inserted to the power delivered to the load impedance after the filter is inserted. Unit of Insertion loss is in dB.

Pass Bandwidth (BWp): The frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value 3dB.

Stop Bandwidth (BWr): The frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value of "A" dB.

Group Delay Ripple (GDR): The difference between the maximum and minimum value of the group delay in the specified range of the pass band. Unit in μ s.

Pass band Ripple (AR): The difference between the minimum peak attenuation and the maximum peak attenuation within a pass band. Unit is in dB.

Terminating Impedance (Zt): Impedance presented to the filter by the source or by the load.

HANDLING PRECAUTIONS

1. Use the SAW product within its maximum ratings.
2. Never apply voltage higher than the maximum rating since high level voltage could accelerate deterioration of the SAW characteristics.
3. The shield grounding condition should be determined so that electrical coupling between input and output may be minimized before using the device. Coupling between input and output will cause ripples in the pass band amplitude and group delay.
4. Storage temperature shall not exceed 85°C.
5. Be careful when using ultrasonic cleaning SAW products since device material and construction is sensitive to ultrasonic vibration.
6. Do not apply sudden or excessive thermal or mechanical shock to the SAW products since it could worsen or deteriorate the SAW characteristics.

ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS

Shock (Drop test): Natural drop on a hardwood board at 1.0m, 3 times. The specimens shall meet the electrical specifications.

Vibration: Frequency with an amplitude of 1.5mm sweeping between 10Hz to 55Hz within 1 minute for 2 hours minimum on each axis on three (3) mutually perpendicular axes. The specimens shall meet the electrical specifications.

Resistance to solder heat: Immerse the leads or terminals in soldering bath at 245° ±5°C for 5 ±0.5 s. 75% or more of the immersed surface shall be covered with solder.

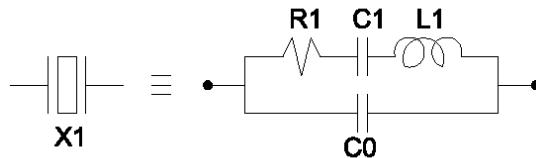
Temperature characteristics: Specimens shall be measured within -40°C to +85°C temperature range. The specimens shall meet the electrical specifications.

Dry heat (aging test): Temperature 125°C ±2°C for 250 hours. The specimens shall meet the electrical specifications.

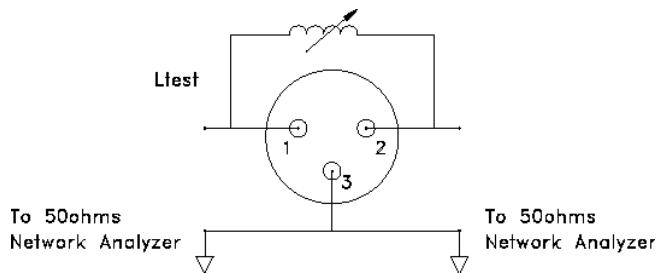
Cold resistance: Temperature - 40°C ±3°C. Duration 96 hours. The specimens shall meet the electrical specifications.

Thermal shock: Heat cycle conditions -55°C (30 minutes), 25°C (5 minutes), +85°C (30 minutes) for 5 cycles. The specimens shall meet the electrical specifications.

EQUIVALENT LC MODEL SAW RESONATOR



TEST CIRCUIT SAW RESONATOR



QUARTZ CRYSTAL GLOSSARY OF TERMS

Nominal frequency: The specified center frequency of the crystal. Unit of frequency is Hertz (Hz). Quartz crystals are specified in kHz or MHz.

Crystal equivalent circuit: The crystal equivalent circuit of the quartz crystal consists of a motional capacitance C_1 , the motional inductance L_1 , a series resistance R_1 , and a shunt capacitance C_0 . The first three parameters are known as the "motional parameters". See figure 1.

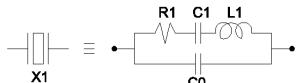


Fig. 1

Operating mode: The quartz crystal could operate at its Fundamental mode or harmonic modes. The fundamental mode is always the preferred oscillating mode. Odd harmonics such as 3rd, 5th, 7th, etc. are overtone modes.

Frequency tolerance: The maximum allowable frequency deviation from a specified nominal frequency at ambient room temperature ($25^\circ\text{C} \pm 3^\circ\text{C}$). Frequency tolerance is expressed in percent (%) or parts per millions (ppm).

Frequency stability: The maximum allowable frequency deviation from the ambient temperature over the temperature range. Frequency stability is expressed in percent (%) or parts per millions (ppm). The frequency stability is determined by cut type, angle cut, angle cut tolerance, mode of operation, package styles, and mechanical dimensions of the quartz blank.

Series vs. Parallel resonance: When a crystal is operating at series resonance (F_s), it looks resistive in the circuit. At this point $|XL| = |XC|$. In series resonance, load capacitance does not have to be specified. The antiresonant frequency (F_a) occurs when the reactance in the series branch is equal to C_0 .

When a crystal is operating at parallel resonance, it looks inductive in the circuit. The crystal equivalent circuit can be simplified as a series resistance R_e with a reactance X_e .

The difference in frequency between the F_s and F_a depends on the C_0/C_1 ratio of the crystal unit, and the inductance L_1 . In parallel resonance, the load capacitance shall be specified.

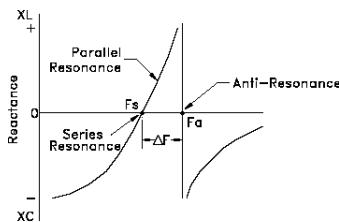


Fig. 2

Equivalent Series Resistance (ESR): The value of impedance the crystal exhibits in the operating resonant circuit.

Aging: The relative frequency change over a certain period of time and is typically expressed as a maximum value in parts per million per year (ppm/year). Typically, aging is computed within the first 30 days to 90 days and predicted exponentially over a longer period usually a year.

Operating temperature: The minimum and maximum temperatures within which crystal unit operates under specified conditions.

Storage temperature: The minimum and maximum temperatures that the crystal unit can be safely stored.

Drive level: A function of the driving or excitation current flowing through the crystal. The drive level is the amount of power dissipated in the crystal and is expressed in milliwatts or microwatts. Drive level should be kept at a safe minimum condition to assure proper start-up. Excessive drive level will result in possible long-term frequency drift or crystal fracture.

Figure 4 shows the relationship between drive level and circuit load

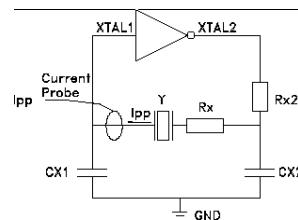


Fig. 3

capacitance and optimum value guarantee for start-up condition.

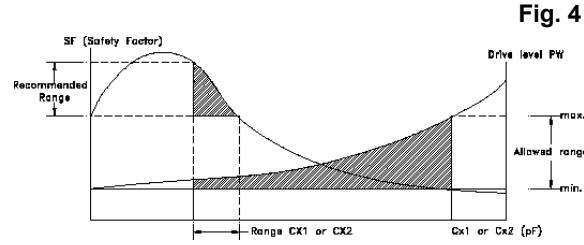
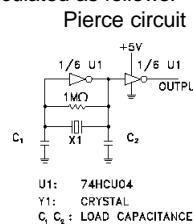
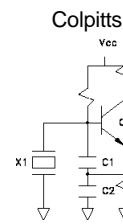


Fig. 4

Load capacitance: Load capacitance (C_L) is the amount of capacitance that the oscillator exhibits when looking into the circuit through the two crystal terminals. Load capacitance needs to be specified when the crystal is used in a parallel mode. Load capacitance is calculated as follows:



Pierce circuit



Colpitts

$$CL = \frac{(C_1 \times C_2)}{(C_1 + C_2)} + C_{stray}$$

Fig. 5

Spurious responses: Unwanted resonance usually above the operating mode, specified in dB max. or number of times of main mode ESR value. Frequency range is specified within couple of hundreds kilohertz.

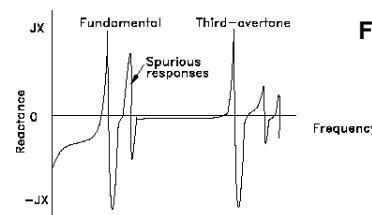


Fig. 6

APPLICATION NOTES

QUARTZ CRYSTAL GLOSSARY OF TERMS

Crystal cuts: A blank wafer is obtained by cutting the quartz bar at specific angles to the various axes. The choice of axis and angle cut determines the physical and electrical parameters of the resonator. Figure 7 shows combinations of X, Y, and Z rotational cuts which are labeled in industry as AT, BT, CT, DT cut, etc. The most two common cuts in Abracan crystals are AT and BT-cuts. There are differences in temperature coefficients of the two cuts.

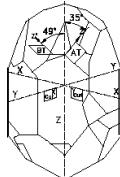


Fig. 7

Vibration modes: The crystal vibrates and produces a steady signal when it is excited with a voltage. The mode of vibration depends on crystal cuts such as thickness shear for AT and BT cuts, length-width flexure for tuning fork, Face shear for CT, DT cuts, etc. Figure 8 shows a thickness-shear mode.

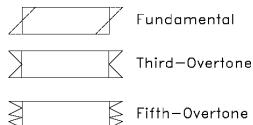


Fig. 8

Shunt capacitance C_0 : The static capacitance between the electrodes (C_e) together with holder capacitance (C_h).

$$C_0 = C_e + C_h$$

C_h varies between 0.6pF to 0.8pF depending on mounting method.

Motional capacitance C_1 : The capacitance of the nominal arm of the equivalent circuit. C_1 results from the elasticity of the quartz blank.

$$C_1 (\text{pF}) = 0.22 \times A (\text{m}^2) \times F (\text{Hz}) / 1670$$

Where A = area of electrode in m^2

Quality factor Q: The factor that represents the sharpness of the resonant curve. Quartz crystal has a very high Q compared to other resonators typically in 10,000 to 100,000s.

$$Q = \frac{2 * p * F_s * L_1}{R_1} = \frac{1}{2 * p * F_s * C_1 * R_1}$$

Pullability: When a crystal is operating at parallel resonance, it looks inductive in the circuit. As the reactance changes, the frequency changes correspondingly, thus change the pullability of the crystal. The difference in frequency between the F_s and F_a depends on the C_0/C_1 ratio of the crystal unit and the load capacitance C_L .

Delta F from series resonant to parallel resonant in ppm:

$$\frac{F_L - F_s}{F_s} = \frac{\Delta F}{F_s} = \frac{C_1}{2(C_0 + C_L)}$$

Pullability can be expressed in terms of load sensitivity (TS) in ppm/pF.

$$TS (\text{ppm/pF}) = \frac{10^6 * C_1}{2(C_0 + C_L)^2}$$

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Negative resistance (-R): Negative resistance is used to evaluate circuit oscillation allowance. Lack of negative resistance could lead to initial circuit start-up and unstable oscillation at steady state.

Procedure:

1. Connect the external resistance R_i in series with the crystal.
2. Adjust R_i value until oscillation stops.
3. Record R_i value.
4. Negative resistance $-R = R_i + R_1$
5. Recommended $-R$ value to be at least 5 to 10 times greater than R_e .

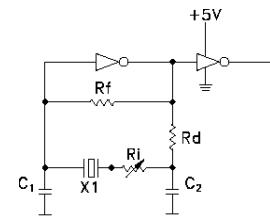


Fig. 9

See figure 9.

Frequency vs. temperature characteristics: Figure 10 shows the frequency – temperature characteristics for a thickness-shear AT-cut crystal. The AT-cut curve has an S-shape symmetrical to room temperature.

Quartz crystals manufacturing process: Quartz crystals are

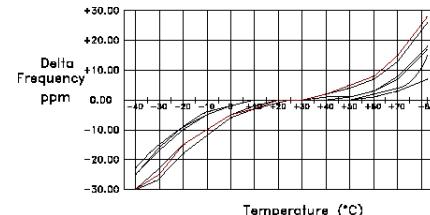


Fig. 10

manufactured in a clean environment to assure high-precision. Highlights of the major steps in manufacturing process of the AT-Cut crystal are described below:

As grown quartz bars – Lumbering – Cutting – Measurement of angle – Precision lapping – Beveling – Etching and Cleaning – Base coating – Mounting – Fine frequency adjusting – Annealing – Sealing – Aging – Final tests and Inspections.

Crystal mounting methods: Quartz blank unit is mounted on holder mounts with conductive epoxy or solder (tuning fork). Precise amount of silver epoxy is applied with automounter

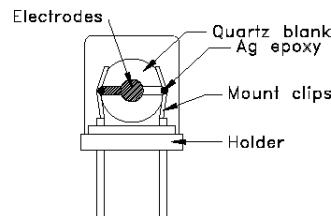


Fig. 11

APPLICATION NOTES

QUARTZ CRYSTALS

The following considerations must be well studied in order to select the right crystal for your applications:

1) ASIC CHARACTERISTICS:

- Negative resistance.
- Small-signal gain analysis.
- Input and output resistance.
- Propagation delay between input and output of inverter.
- Gain-phase analysis.
- Supply voltage operational margin.
- Circuit configuration.
- Feedback resistor value (if integrated within the ASIC).
- Built-in load capacitance on X1 and X2 ports.
- Sensitivity of inverter operation versus stray inductance or capacitance due to layout or attachment methods.

2) CRYSTAL CHARACTERISTICS:

- Mode of Operation (Fundamental -vs.- Overtone).
- Series -vs.- Parallel.
- If Parallel: State "Load Capacitance".
- If Overtone: specify design without inductor or conventional tuning tank LC Circuit.
- Maximum Resistance.
- Drive Level dependency.
- Operating Temperature.
- Frequency Accuracy at 25°C.
- Frequency Stability over Temperature.
- Aging.
- Pulling Characteristics.
- Spurious Responses.

3) CIRCUIT CONSIDERATIONS:

- **Select the best value for R_f (feedback resistor).**
Recommend Value:
Low kHz Range: between 10 MΩ to 20 MΩ
MHz Range: between 100 kΩ to 1 MΩ
- **Select Series Resistance Value (R_d) for impedance matching.** R_d selection varies with ASIC negative resistance, output resistance and load impedance. Typical Value for R_d: 0 Ω (Short) to 1 kΩ from 4 MHz to 30 MHz.
- **Study the Voltage Gain from output V_i / V_o = C₂ / C₁.** It is very common to select equal values of C₁ and C₂ in the circuit, but sometimes it is necessary to make the output load capacitance (C₂) higher to compensate for the signal losses through the crystal and feed back loop.
- **Maximum Crystal Resistance Allowed.** Low resistance is desirable for better operational margin and stability. However, crystal resistance varies with frequency, blank size. Low crystal resistance could affect yield and therefore cost.
- **Typical Crystal Aging: ± 5 ppm per year maximum.** Aging over 10 years: ± 10 ppm to ± 15 ppm maximum. Tighter aging (up to ± 1 ppm per year max.) is available. Tighter aging requires extremely high design, manufacturing and additional post-tests.
- **Inductorless Third (3rd) Overtone:** The Inductorless 3rd-Overtone circuit is similar to the fundamental

frequency circuit except the feedback resistor value is made much smaller (typical value varies between 2 kΩ to 6 kΩ). In this case, the component of inductive admittance due to the resistor is greater than the admittance of the loading capacitance at the fundamental frequency, thereby preventing oscillation at the fundamental frequency. In the meantime, the inductive admittance at the overtone is less than the admittance of the Load Capacitor thus enabling the oscillation at the third-overtone. (See figure 1.)

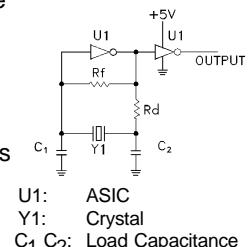


Figure 1

Tuning Tank LC Overtone Circuit

- In an overtone mode, an additional inductor L₁ and capacitance C_c is required to select the 3rd-Overtone mode, while suppressing or rejecting the fundamental mode. Choose L_c and C_c component values in the 3rd-overtone crystal circuit to satisfy the following conditions:
- The L_c / C_c component form a series resonant circuit at a frequency below the fundamental frequency, which makes the circuit look inductive at the fundamental frequency. This condition does not favor to oscillation at the fundamental mode.
- The L₁ / C_c and C₂ components form a parallel resonant circuit at a frequency about half-way between the fundamental and 3rd-Overtone frequency. This condition makes the circuit capacitive at the 3rd-Overtone frequency, which favors the oscillation at the desired Overtone mode. (See figure 2.)
- The Lc tank may be located at either input or output of the inverter. However, the Lc tank at the out put is referred, because it helps to clean up all unwanted modes before signal goes through the crystal.

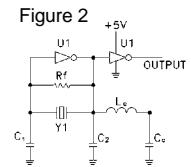
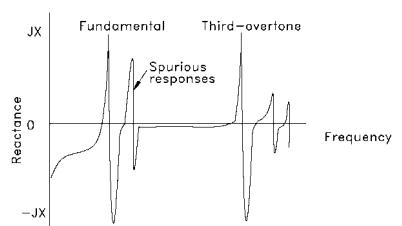


Figure 2

4) CONTROL UNWANTED MODES IN CRYSTALS:

Unwanted modes are resonant modes in addition to the desired modes (Fundamental, Third-Overtone, Fifth overtone, etc.). The frequencies of these unwanted modes are usually slightly higher than the desired modes within couple of hundreds kilohertz. In oscillator applications, it is necessary to control unwanted modes as lower as possible to prevent circuit oscillating in the "spurious mode". See Figure 3. The design of large electrodes on crystal to produce large pulling is a common cause of promoting spurs. Unwanted modes are usually specified in terms of resistance or in terms of the ratio of resistance of the unwanted mode to the resistance of the main mode over a bandwidth of desired frequency. A resistance ratio of 2:1 or a minimum of 3dB separation is usually adequate.



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29 Journey • Aliso Viejo, CA 92656 • USA
(949) 448-7070 • FAX: (949) 448-8484
E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com

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APPLICATION NOTES

QUARTZ CRYSTALS

Q: Why does my crystal works sometimes, but not others?

A: This is the most common complaint heard from crystal users. Unless the crystal supplier knows this common mode of failure, and applies preventive measures, this common problem can be solved earlier in design stage. Some customers describe these crystals as "sleeping crystals". The circuit start-up sometimes and does not at other times, unless been touched with a scope probe or fingers. Abracan predicts this problem in our Design and Process Failure Mode Effect Analysis (DFMEA and PFMEA) with two main root causes:

- a) Blank cleanliness.
 - b) Drive level dependency.
 - c) IC matching.
- Blank cleanliness: We use special blank wafer ultrasonic cleaning procedure in De-ionized water and 99.99% Isopropyl Alcohol with modulated air method to guarantee highest quality.
- Drive level dependency: On most production lots, we perform 100% DLD tests at five levels minimum starting from $1\mu\text{W}$ to $500\mu\text{W}$. The DLD test will guarantee that the changes in ESR and frequency are within maximum limits thus assure the initial power start-up.
- Typical ΔFDLD : $\pm 5\text{ppm}$ max.
Typical ΔRDLD : 25% max.
- IC matching: Abracan offers IC matching process to our customers in early design stage. The IC matching process will identify the optimum values of load capacitors, feedback and series resistors, drive level vs. load cap, voltage margin, open-loop gain at resonance, and temperature characteristics. Please consult Abracan for details.

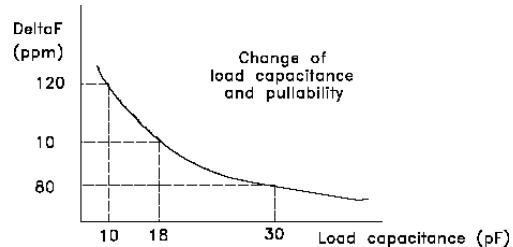
Q: How to specify a pulling crystal?

A: Many applications in VCXO, PLL network require a crystal with pulling characteristics. The pullability of the crystal can be explained as follow:

When a crystal is operating at parallel resonance, it looks inductive in the circuit. As the reactance changes, the frequency changes correspondingly, thus change the pullability of the crystal. The difference between the F_s and F_a depends on the ratio C_0/C_1 ratio of the crystal.

The following crystal parameters specify the pullability:

- Motional capacitance C_1 in fF.
- Motional inductance L_1 in mH
- The difference of the parallel resonant frequency $\Delta F = F_{L2} - F_{L1}$



- Ratio of shunt capacitance to motional capacitance C_0/C_1 . The smaller ratio the better the pulling.

The pullability of the crystal can be designed to meet customer's requirements. However, the pulling function varies with package size, electrode size, frequency, load capacitance range, and operating mode. Please contact Abracan whenever you have a need for a pulling crystal.

Q: What is the trend of crystal packaging and advantages?

A:

- Minimizing the size and weight of mobile communication application such as cellular phones, PCMCIA, PDA, etc.
- Improve sealing technologies from resin sealing to seam sealing to Electron beam sealing.
- Advanced small quartz blank design in smaller ceramic packages such as $5.0 \times 3.2\text{mm}$, $3.2 \times 2.5\text{mm}$, etc. The fundamental frequency increases up to 66MHz helps simplify circuit design and is more efficient compared to the old traditional third-overtone circuit complexity.
- Features of E-Beam sealing:
 - 3 Tight stability and tight tolerance ($\pm 10\text{ppm}$).
 - 3 Low ESR and high reliability by vacuum package.
 - 3 Resistance to shock and moisture.
 - 3 High productivity captured with seam sealing method.
 - 3 Miniaturization by fine processing of E-Beam.
- LTCC packaging helps reducing size and external components.

APPLICATION NOTES

ULTRA LOW NOISE SPREAD-SPECTRUM CRYSTAL OSCILLATORS

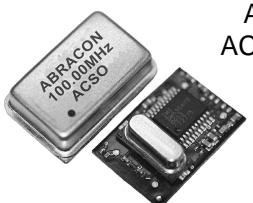
EMI Protection and Spread-Spectrum Technology:

The FCC and the European Community (under CE Mark EMC Directive) require electronic devices to comply with appropriate radiation emission standards. Other international communities such as Asia and Australia are also following the same rules. Practically every electric device and equipment generate unintended electromagnetic radiation, which will get worse as technology advances, especially with even faster electrical signals required in PC, digital devices and equipment.

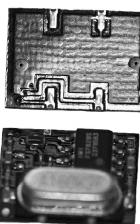
With the recent advance in semiconductor and computing technology, (faster clock speeds, lower voltage/power, etc.), coupled with the explosion of the wireless technologies, it is easy to understand why EMI is becoming one of the most important standard requirements in the new-technology world.

In the past, shielding and filtering were the most prevalent method used to control EMI. This method of shielding and filtering can get very expensive. As frequency increases, the effects of transmission line and ground impedance will amplify the radiation, and at the same time wavelength decreases, making shielding and filtering less effective.

The present trend is to control EMI at the source, the single clock oscillator using spread-spectrum technology.



ACSO and
ACSOL Series



ASSM and
ASSML Series



ACSH and
ACShL Series



THEORY:

Spread-spectrum is, more or less, frequency modulating the clock signal with a unique waveform. In the frequency domain, this is equivalent to reducing the peak by distributing the energy of each fundamental and harmonic over a wide range. The spread-spectrum method must be controlled and slow compared to the clock rate to guarantee that the change in the clock rate is transparent to the system. Essentially, spread-spectrum is a modulation method where the modulation is measured as a percentage.

For example, a 0.5 percent modulation means that a 100MHz clock is modulated between 99.5MHz and 100.5MHz. This is called a center 0.5 percent modulation, since the 100MHz fundamental frequency remains the center frequency. The designer must keep in mind that both cycle-to-cycle and peaking jitter must remain within the system's specifications.

Another important factor is the modulation frequency, which is usually in the kilohertz range. This is basically a measure of the rate at which the frequency is swept between 99.5 and 100.5. The linear sweep is predictable and most prevalent.

Overall, the spread spectrum method has allowed system performance to increase without compromising EMI. Using Abracon spread-spectrum clock oscillators will not only reduce packaging, shielding, and design-cycle costs, but also expedite time-to-market of products which otherwise may fail regulatory EMI limits and standards. Abracon ultra low noise series oscillators provide an economical solution to expensive EMI problems.

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APPLICATION NOTES

CERAMIC RESONATORS

Why Ceramic Resonators? Ceramic resonators stand between quartz crystals and LC/RC oscillators in regard to accuracy. They offer low cost and high reliability timing devices with improved start-up time to quartz crystals.

Package styles: Abracon offers a wide variety of package styles for ceramic resonators. They come with two or three terminals leaded type or surface-mount type. We also offer the washable industrial grade ceramic resonators with gold flash terminals on the surface-mount types (AWSZR, AWSZT).

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 wafer by an applied electric field.

Oscillation mode: The ceramic resonator oscillates in thickness-shear vibration mode for Fundamental frequencies (typical less or equal than 8MHz) and thickness-longitudinal vibration mode for third-overtone mode (above 8MHz to 50MHz).

Frequency range: The available frequency range varies from 182kHz to 50MHz.

Frequency tolerance at 25°C: The maximum allowable frequency deviation from the nominal frequency at room temperature. Frequency tolerance is expressed in percent. Typical frequency tolerance is $\pm 0.5\%$ max. Frequency tolerance can be controlled tighter on built-in capacitance type.

Frequency stability: The maximum allowable deviation compared to the measured frequency at 25°C over the temperature window, i.e. -20°C to +80°C or -40°C to +125°C. Standard frequency stability is $\pm 0.3\%$.

Resonant Impedance: The net impedance of the ceramic resonator at resonant frequency. Ceramic resonators have superior resonant impedance than quartz crystal, which offer much better start-up time.

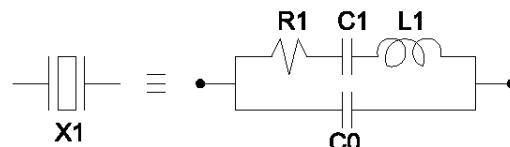
Aging: The relative frequency change over 10 years period. The aging is $\pm 0.3\%$ max. over 10 years.

Load capacitance CL: Since ceramic resonators have very large parallel resonance area and frequency is very sensitive to load capacitance, exact value of load capacitance must be specified. This process is usually been done through IC matching and characterization. Please contact Abracon for details.

Equivalent circuit: The equivalent circuit of the ceramic resonator is similar to the quartz crystal, but motional parameters are very different.

See figure 1 below:

For 4MHz: L1 = 385 μ H, C1 = 4.4pF, C0 = 36.3pF, R1 = 8 Ω , Q = 1134, ΔF = 228kHz.



Manufacturing Process: Material Mixing – Calcination – Milling – Spray Dry Seving – Pressing – Sintering – Printing – Sintering – Poling – Slicing – Sputtering – Dicing – Wire forming – Soldering – Lead frame insert – Wax coating – Epoxy coating – Epoxy curing – Inspection – Packaging – Shipping.

Why do ceramic resonators have lower cost than quartz crystals?: Because ceramic resonators have high mass production rate, small size, no need for adjustment.

Properties of automotive and industrial grade ceramic resonators: Abracon offers a new line up of automotive and industrial grade ceramic resonators operating at -40°C to +125°C, in supplement to its current consumer grade products which are operating at -20°C to +80°C. The automotive grade, which offers excellent frequency tolerance, stability, provides a reliable start-up over the wide temperature. The parts can be ultrasonic (1 minute at 60°C, frequency 28kHz, output 20W/L) or rinse washed with water for a limited time and must be dried completely to guarantee performance.

IC characterization for ceramic resonators: Due to ceramic resonators' properties, IC matching must be studied and performed to satisfy oscillation conditions. The following possible causes may occur if IC matching was not performed:

- In-circuit oscillation frequency off tolerance limit.
- Not-start-up or start-up at an unwanted frequency.
- Stop oscillating or oscillating off limits over temperature.
- Oscillation at overtone mode.
- Poor aging due to over power driving.

Also, there is possibility between frequency correlation between test jig and customer IC. The circuits below show an example between IC characterization of a TMP87P808M and correlation of in-house test jig using CD4069UBE.

APPLICATION NOTES

QUARTZ CRYSTAL OSCILLATORS GLOSSARY OF TERMS

Nominal frequency: The center or nominal output frequency of a crystal oscillator.

Package: Crystal oscillators are packaged in various styles from lead through holes to surface-mount types. Various sizes and functions are suitable for different applications.

Frequency tolerance: The deviation from the nominal frequency in terms of parts per millions (ppm) at room temperature. ($25^\circ \pm 5^\circ\text{C}$)

Frequency range: The frequency band that the oscillator type or model can be offered.

Frequency stability: The maximum allowable frequency deviation compared to the measured frequency at 25°C over the temperature window, i.e., 0°C to $+70^\circ\text{C}$. Typical stability is $\pm 0.01\%$ ($\pm 100\text{ ppm}$).

Operating temperature: Temperature range within which output frequency and other electrical, environmental characteristics meet the specifications.

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 $\pm 5\text{ppm}$ over 1 year maximum.

Storage Temperature: The temperature range where the unit is safely stored without damaging or changing the performance of the unit.

Frequency vs. Power Supply Variation: Maximum frequency change allowed when the power supply voltage is changed within its specified limits (typical $\pm 10\%$ in VCC or $\pm 5\%$ change).

Supply Voltage (Vdd max): The maximum voltage which can safely be applied to the Vcc terminal with respect to ground. Maximum supply voltage for TTL is 5.5V and for HCMOS is 7V.

Input Voltage (VIN): The maximum voltage that can be safely applied to any input terminal of the oscillator.

Output HIGH voltage (VOH): The minimum voltage at an output of the oscillator under proper loading.

Output LOW voltage (VOL): The maximum voltage at an output of the oscillator under proper loading.

Input HIGH voltage (VIH): The minimum voltage to guarantee threshold trigger at the input of the oscillator.

Input LOW voltage (VIL): The maximum voltage to guarantee the threshold trigger at the input of the oscillator.

Supply Current (Icc): The current flowing into Vcc terminal with respect to ground. Typical supply current is measured without load.

Symmetry or Duty Cycle: The symmetry of the output waveform at the specified level (at 1.4V for TTL, at 1/2 Vcc for HCMOS, or 1/2 waveform peak level for ECL). See Fig. 1

$$\text{SYM} = \frac{t_H}{T} \times 100 (\%)$$

Fan Out: The measure of driving ability of an oscillator, expressed as the number of inputs that can be driven by a single output. It can be represented by an equivalent load capacitance (CL) or a TTL load circuit consisting of diodes, load resistor, and a capacitor.

Rise Time (T_r): Waveform rise time from Low to High transition, measured at the specified level

10% to 90% for HCMOS,

20% to 80% for ECL

0.4V to 2.4V for TTL.

Fall Time (T_f): The waveform fall time from High to Low transition, measured at the specified level

90% to 10% for HCMOS,

80% to % for ECL

2.4V to 0.4V for TTL.

Jitter: The modulation in phase or frequency of oscillator output.

HCMOS / TTL Compatible: The oscillator is designed with ACMS logic with driving capability of TTL and HCMOS loads while maintaining minimum logic HIGH of the HCMOS.

Tristate Enable: When the input is left OPEN or tied to logic "1", the normal oscillation occurs. When the input is Grounded (tied to logic "0"), the output is in high impedance state. The input has an internal pull-up resistor thus allowing the input to be left open.

Output Logic: The output of an oscillator is designed to meet various specified logic states, such as TTL, HCMOS, ECL, Sine, Clipped-Sine (DC cut).

Harmonic Distortion: The non-linear distortion due to unwanted harmonic spectrum component related with target signal frequency. Each harmonic component is the ratio of electric power against desired signal output electric power and is expressed in terms of dBc, i.e. -20dBc. Harmonic distortion specification is important especially in sine output when a clean and less distorted signal is required.

Phase Noise: The measure of the short-term frequency fluctuations of the oscillator. It is usually specified as the single side band (SSB) power density in a 1Hz bandwidth at a specified offset frequency from the carrier. It is measured in dBc/Hz.

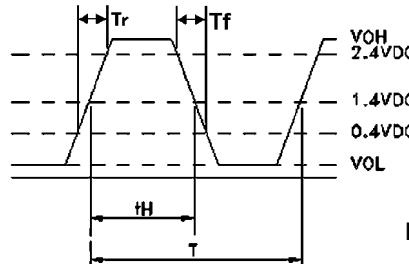


Figure 1.

$$\text{Symmetry} = \frac{t_H}{T} \times 100\%$$

Stand By: A function that temporary turns off the oscillator and other dividers to save power. Logic "0" will enable stand by mode. The disable current at stand by mode varies from a few micro-amperes to tens of micro-amperes (5μA typical). Because oscillation is halted, there is a maximum of 10 ms (same amount of start-up time) before output stabilizes.



APPLICATION NOTES

QUARTZ CRYSTAL OSCILLATORS

Q: Introduction to Abracon Programmable Oscillators:

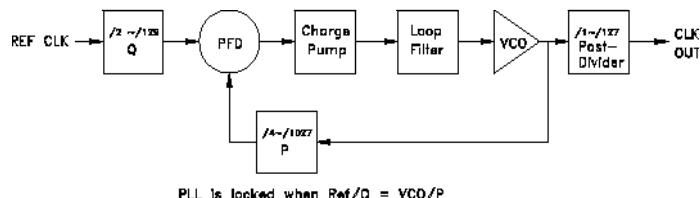
A: Abracon offers quick-turn programmable oscillators in four different package styles; the ceramic package 7.0 x 5.0 x 1.6 mm, plastic molded package similar to Epson SG-8002, and the 14 pin and 8 pin dip packages. The single PLL architecture with EPROM programmable generates a custom frequency derived from an internal crystal between 10MHz to 25MHz. The main advantages of the programmable oscillators are:

- | Easy customization and fast turnaround.
- | Wide frequency ranges 1MHz to 133MHz.
- | Programming accuracy > 6 digits.
- | Output control Synchronous or Asynchronous.
- | Output levels CMOS or TTL.
- | Fast rise and fall times.
- | Fast programming time < 5 seconds per unit.
- | Low skew, low jitter, high accuracy outputs.
- | Enables design flexibility and easy of use.
- | Powerdown and output enable options available.
- | Configurable 5V or 3.3VDC operation in seconds.
- | Reprogrammable for quick design changes (applied to blank only).
- | Extended temperature -40°C to +85°C with good frequency vs. temperature characteristics.

Q: What is PLL technology?

A: A PLL allows a frequency to be generated from any other frequency, where:

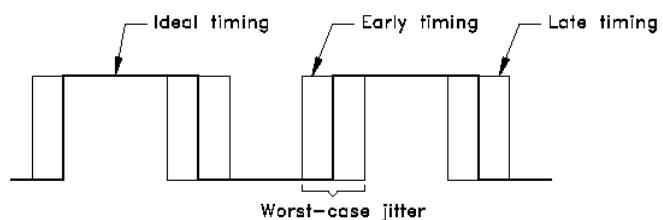
$$\text{CLK OUT} = \frac{\text{REF. CLK} * \text{P/Q}}{\text{Post-Divider}}$$



Q: What is jitter?

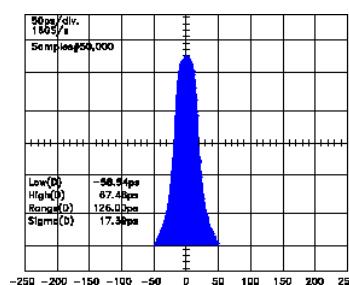
A: Jitter is the uncertainty or short-term variations of a digital waveform timing from their ideal positions in time.

The waveform transition could be too early or too late compared to the ideal waveform timing.



Q: How to measure jitter?

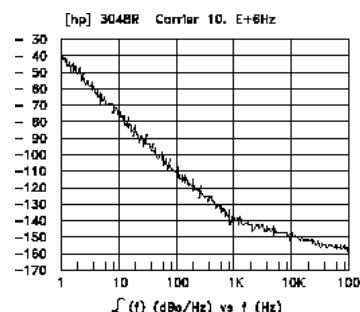
A: We use LeCroy digitizing oscilloscope with jitter timing software for jitter measurement and analysis. The scope must have the bandwidth at least five times the frequency of the waveform since the waveform jitter is measured as each rising cycle crosses the threshold voltage. The larger number of continuous cycles the more accurate is the jitter distribution. Jitter is measured in cycle-to-cycle



(or absolute jitter) or one sigma jitter (rms.) using the histogram analysis. Unit of jitter is ps.

Q: Can phase noise be improved in designs?

A: Yes. Crystal oscillators can be designed to minimize their phase noise characteristics. Special applications such as wireless require best phase noise both at far-end and close-end. Crystal parameters and mounting methods directly affect close-end phase noise 300Hz offset from carrier. The oscillator front-end and output buffer



APPLICATION NOTES

QUARTZ CRYSTAL OSCILLATORS

Q: Why the Overall frequency stability is specified in crystal oscillators but not in crystals?

A: The crystal oscillator is typically used as a master clock for the microprocessor and its parameters are not affected by the internal characteristics of the microprocessor such as variation in load capacitance and other variables that could affect the change in frequency at room and over temperature. The overall frequency stability in crystal oscillators is typically $\pm 100\text{ppm}$ max. and includes frequency calibration at 25°C , over temperature, frequency changes due to load, supply, aging, vibration, and shock.

Q: What is the start-up time?

A: Start-up time is the delay time between the oscillation starts from noise until it reaches its full output amplitude when power is applied. The supply voltage must be applied with a defined rate or rise. The start-up time varies from microseconds to milliseconds depending on frequency, ASIC speed and logic. Please see figure 1.

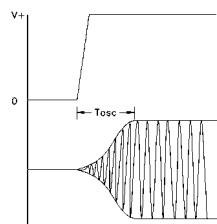


Figure 1

Q: What is Tristate Enable/Disable mode?

A: When the voltage at the control pin is set to a logic low "0", the output is in Tri-state mode that is High Impedance. The disabled current is usually lower than its normal operating current but not completely cut-off as it was seen in the Stand-by mode, where the oscillation is shut down completely. There is an internal pull-up resistor between control pin and supply (typically $100\text{k}\Omega$), therefore the control pin can be left open (floating) if unused.

Q: What is jitter and how to specify its maximum value?

A: Jitter is noise caused by many sources in crystal oscillators. Major sources of noise are:

- Power supply noise.
- Integer multiples of the signal source frequency (harmonics).
- Load and termination conditions.
- Amplifier noise.
- Circuit configuration (PLLs, Multiplier, Overtone, etc.)

The following methods can be used to suppress the noise conditions in the above sources:

- Make sure that the power supply noise is filtered by using by pass capacitors, chip beads, or RC filters.
- If jitter is critical in some applications, especially for high- frequency noise, use low harmonics outputs or sine output.
- Make sure that load and termination conditions are optimized to avoid reflected power back to its output.
- Typically, PLLs, Multiplier or Programmable designs produce higher jitter than the conventional fundamental design.

It is very important to understand the jitter requirements from the application to specify the right specification for crystal oscillators.

We can classify two types of jitters:

- Cycle to cycle jitter
- Period jitter.

CYCLE TO CYCLE JITTER

The Cycle to cycle jitter is the maximum difference in time between several measured periods. Usually a minimum of ten (10) cycles is used where T1 to T10 were recorded . See fig. 2.

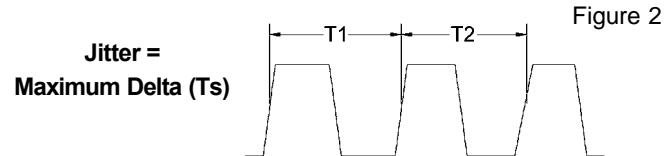


Figure 2

PERIOD JITTER.

The period jitter is the maximum change of a clock edge. It is usually expressed as peak-to-peak jitter and can be converted to rms value by multiplying to $(0.5) \times (0.707)$. The period jitter can only be measured at each cycle but not multiple cycles. See figure 3.

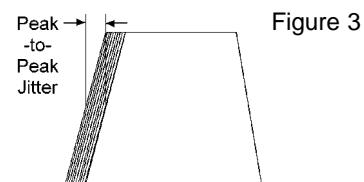


Figure 3

Typical jitter recorded in Abracan oscillators varies from 20ps to 60ps rms.

Q: What is phase noise and how to measure it?

A: Phase noise is the expression of noise in the frequency domain. It is a measure of the short-term frequency fluctuations of the oscillator. It is usually specified as the single sideband power density in a 1Hz bandwidth at a specified offset frequency from the carrier.

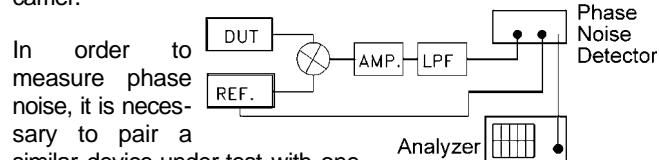


Figure 4

In order to measure phase noise, it is necessary to pair a similar device-under-test with one unit set a VCXO and other set a fixed XO. Please see block diagram in figure 4.

Typical phase noise in Abracan VCXO and oscillators:

OFFSET FREQUENCY (Hz)	PHASE NOISE (dBc/Hz)
10	-70
100	-110
1,000	-125
10,000	-150
100,000	-160

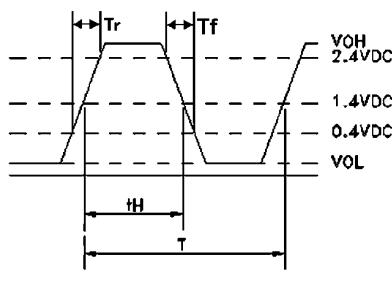
APPLICATION NOTES

QUARTZ CRYSTAL OSCILLATORS

CMOS RISE AND FALL TIMES

The rise and fall time on the CMOS technology depends on its speed (CMOS, HCMOS, ACMOS, BICMOS), the supply voltage, the load capacitance, and the load configuration. Typical rise and fall time for CMOS 4000 series is 30ns, HCMOS is 6ns, and for ACMOS (HCMOS, TTL compatible) is 3 ns max.

Typical rise and fall time is measured between 10% to 90% of its waveform level.



OUTPUT WAVEFORM

Figure 1

ACMOS OUTPUT TERMINATION TECHNIQUES

Due to the fast transition time of the ACMOS (HCMOS/TTL compatible) device, proper termination techniques must be used when testing or measuring electrical performance characteristics.

Termination is usually used to solve the problem of voltage reflection, which essential cause steps in clock waveforms as well as overshoot and undershoot. Such effect could result in false clocking of data, as well as higher EMI and system noise.

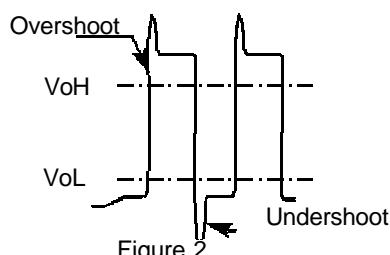


Figure 2

Termination is required also because of the length of the trace on the PC board and its load configuration.

There are three general methods of terminating a clock trace, which is a process of matching the output impedance of the device with the line impedance:

- 1) Series termination;
- 2) Pull-up/Pull-down termination;
- 3) Parallel-AC termination

METHOD 1:

Series termination (Fig. 3)

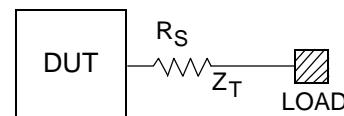


Figure 3

$$R_S \geq Z_T - R_o$$

In series termination, a damping resistor is placed close to the source of the clock signal. Value of R_S must satisfy the following requirement:

METHOD 2:

Pull-Up / Pull-Down Resistors (Fig. 4)

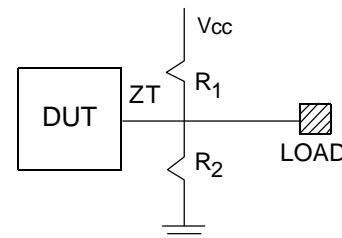


Figure 4

In pull-up/pull-down termination, the Thevenin's equivalent of the combination is equal to the characteristics impedance of the trace. This is probably the cleanest, and results in no reflections, as well as EMI.

$$R_T \sim Z_T$$

METHOD 3:

Parallel AC Termination (Fig. 5)

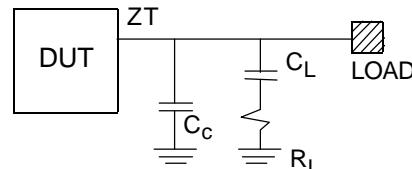


Figure 5

In parallel AC termination, a R-C combination is placed at the load. The value of the capacitor must be chosen carefully, usually smaller than the 50pF. This termination is not recommended because it will degrade the rise and fall time of the clock, although it draws no DC current.

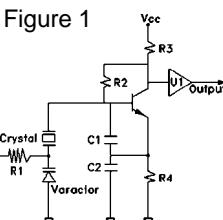
APPLICATION NOTES

VCXOs and TCXOs

Q: What are the factors that affect frequency pullability?

A: The frequency pullability or deviation in VCXO is the change in the output frequency with respect to change in control voltage. Pullability is usually specified as minimum; however, in some applications, a maximum pulling value is also specified to avoid circuit instability.

Please refer to figure 1 for a typical Colpitts VCXO circuit:



Some major factors that affect the frequency deviation in VCXO:

- Load capacitance value C1 and C2.
- Frequency.
- Crystal characteristics (C1, C0/C1, size)
- Varactor type and capacitance.
- Voltage control Vc.
- Operating temperature.

The frequency pullability can be increased either by using a low capacitance with sharp slope varactor, connect in series another varactor or an inductor, adjusting load capacitor values C1 and C2, or increasing control voltage.

Be very careful when considering any above methods because it may create circuit instability which has a severe effect on jitter, linearity, unwanted modes, frequency hysteresis, or frequency shift over temperature.

Q: What is the typical input impedance?

The input impedance is a function of modulation frequency. Its minimum input impedance is 50kW at 10kHz.

Q: What is the transfer function?

A: The transfer function is the direction of change in frequency versus the change in control voltage. Most applications require a positive transfer function, which the frequency rises when increasing control voltage.

Q: What is linearity and what are the factors that affect it?

A: Linearity is the deviation from the best straight-line slope of the frequency versus control voltage curve. The typical linearity in Abracon VCXO is $\pm 10\%$ maximum for standard pullability. Larger pulling may worsen the linearity.

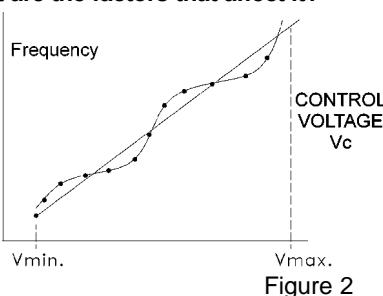


Figure 2

Q: What is the modulation bandwidth?

A: The modulation bandwidth is the minimum $\pm 3\text{dB}$ bandwidth frequency, relative to a 1kHz to 10kHz modulation frequency. Unless otherwise specified as default, other values of modulation bandwidth and frequency must be specified when ordering.

Q: What is the control voltage?

A: The control voltage is the external voltage applied to the input of the VCXO. It consists of a minimum, a maximum, and a center voltage. The center control voltage is the nominal voltage that sets the oscillation frequency to its minimal value.

Standard control voltages:

$V_c \text{ min} = 0.5\text{Vdc}$; $V_c \text{ max.} = 4.5\text{Vdc}$; $V_c \text{ center} = 2.5\text{Vdc} \pm 0.5\text{V}$

Q: What is a TCXO?

A: A TCXO (Temperature-Compensated Crystal Oscillator) is a crystal oscillator that has a high-precision crystal, a temperature-compensated network. There are several methods to design a compensated network, which could vary from simple, less expensive to, complicate and very expensive:

- **Method 1:** Thermistor/Capacitor networks (Direct compensation). Lowest cost, no varactor needed.
- **Method 2:** Traditional thermistor network.
- **Method 3:** Analog Polynomial Generator
- **Method 4:** Digitally segmented analog
- **Method 5:** Digital compensation
- **Method 6:** Digital compensation with DAC voltage summers.

Figure 3 shows a traditional thermistor network:

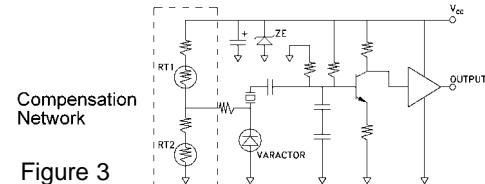


Figure 3

Q: Why and when we need to use a TCXO?

A: We need to use a TCXO when the frequency stability of the oscillator falls beyond the design limitation of a standard simple (fixed) crystal oscillator which is typically less than $\pm 5\text{ppm}$ over a standard or extended temperature window. The TCXO costs more due to its complex circuit and manufacturing.

Q: Why there is an internal trimmer or control voltage on a TCXO?

A: The purpose of the internal trimmer (variable capacitor) or a control voltage is to re-adjust the frequency to its nominal frequency for aging compensation or initial setting.

The internal trimmer is accessible via a hole on top of the TCXO can and can be adjusted with a special tool.

The control voltage can be set with a voltage divider or an external voltage. Both methods of adjustment usually can not produce large frequency deviation rather than 5 to 15ppm enough to offset the frequency due to standard aging.

Q: How to specify frequency stability on a TCXO?

A: Unless otherwise specified, the frequency stability on a TCXO is specified as follows:

- Due to temperature change: $\pm 2.5\text{ppm}$ @ -20°C to $+70^\circ\text{C}$
- Due to aging: $\pm 1\text{ppm}$ per year max.
- Due to supply voltage ($\pm 5\%$): $\pm 0.3\text{ppm}$ max.

The frequency drift due to temperature change is referred to nominal frequency set at 25°C .

APPLICATION NOTES

MONOLITHIC QUARTZ CRYSTAL FILTERS

Holder: A case housing a thin piece of quartz crystal with vacuum-evaporated metal electrodes and terminals for connections.

Nominal Frequency: Normally this refers to the nominal value of the center frequency given in the specifications, to which other frequencies may be referred. Nominal frequency usually indicates the Center Frequency (F_0) and Carrier Frequency (F_c).

Pass Bandwidth: The pass bandwidth in which the attenuation is equal to or less than a specified value insertion loss.

Stop Bandwidth: The stop bandwidth in which the attenuations are equal to or greater than specified values in the stop band attenuation.

Ripple: The ripple (in pass band) is the difference between the maximum and minimum attenuation within a passband.

Insertion Loss: The logarithmic ratio of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.

Attenuation Bandwidth: The frequency width at the value that assures the relative attenuation is of the same value or higher than the specified attenuation.

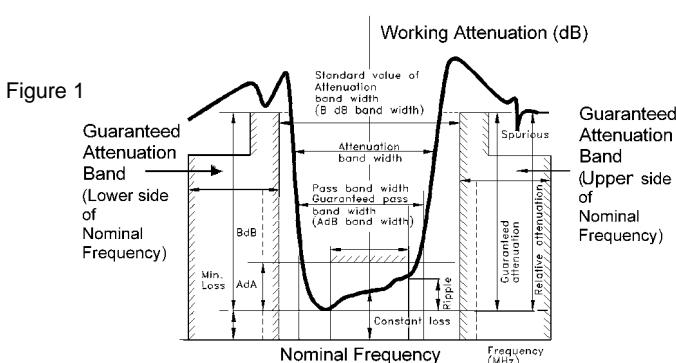
Attenuation Guaranteed: The maximum attenuation guaranteed at the specified frequency range.

Termination Impedance: Either of the impedance presented to the filter by the source or by the load, and described the resistive portion (R_t) and the parallel capacitive portion (C_t) including stray capacitance.

Spurious Response: Minimum attenuation caused by extraordinary response in the stopband. Spurious response usually appears at a frequency higher than the center frequency.

Group Delay distortion: The difference between the maximum and minimum group delay within pass bandwidth unless otherwise specified.

Balanced Type and Unbalanced Type: A balanced type is one in which a pair of terminals is not connected to the case. An unbalanced type is one in which one of a pair of terminals is connected to the case.



NOTES: (1) AdB: Attenuation which specifies the band width.

(2) BdB: Attenuation which specifies the Attenuation Band Width.

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CRYSTAL FILTERS TEST SET-UP

The termination impedance presented by the source or by the load is either represented by a resistor and a capacitor (capacitive type) or by a resistor and a "negative" capacitor (inductive type). For a capacitive type, specified value of capacitor as given in table can be used in the test circuit. For an inductive type ("negative capacitance"), a L-C network is required to compensate the negative capacitance.

TESTING CONFIGURATION

Two pole filters are cascaded to produce four, six, eight or more pole filter responses with the addition of coupling capacitances between two pole sections.

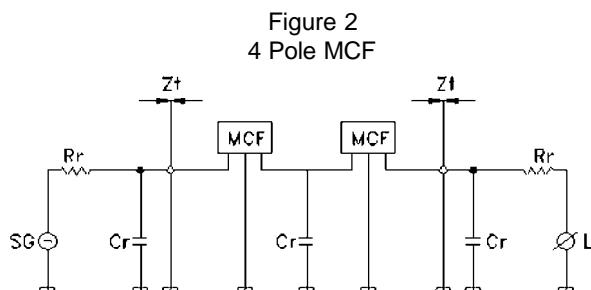


Figure 2
4 Pole MCF

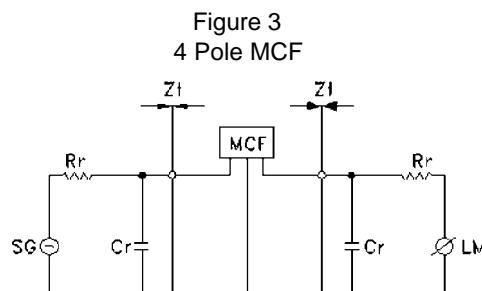


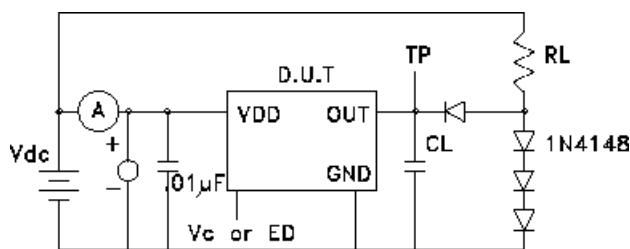
Figure 3
4 Pole MCF

APPLICATIONS

Crystal filters have high stability temperature characteristics and have narrow band, low loss and good attenuation bandwidth. They are widely used in mobile communications systems, mobile and cordless telephones, pagers and radios. Abracon will manufacture crystal filters per custom specifications, including termination impedance, pass band width and attenuation band width.

QUARTZ CRYSTAL OSCILLATORS

Test Circuit TTL



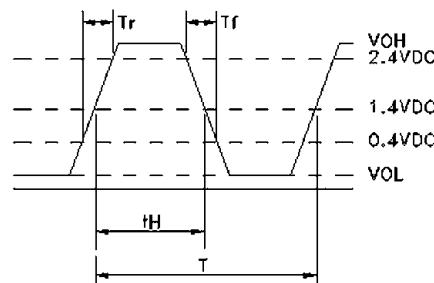
$RL = 2.0k\Omega$ (2TTL)

$RL = 820\Omega$ (2TTL)

$RL = 390\Omega$ (2TTL)

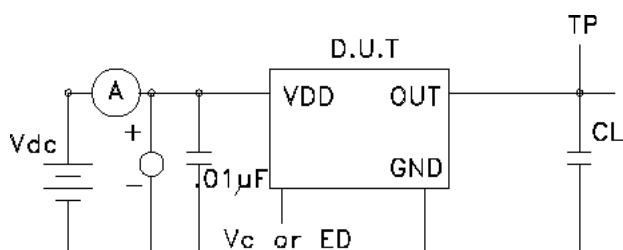
$CL = 15pF$ (including probe capacitance)

TEST WAVEFORM

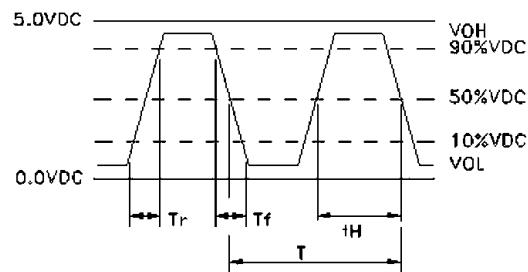


$$\text{Symmetry} = \frac{t_H}{T} \times 100\%$$

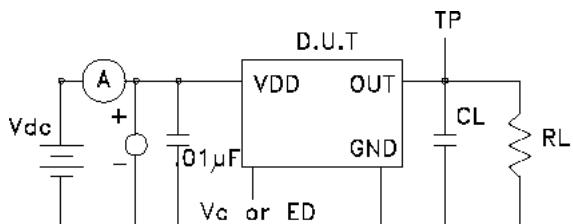
Test Circuit HCMOS



$CL = 15pF$ (including probe capacitance)



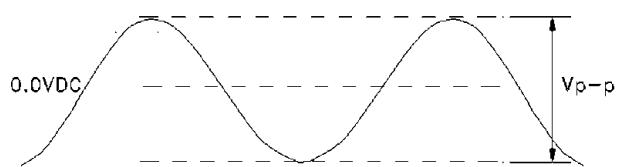
Test Circuit Clipped Sine



$RL = 10k\Omega$

$CL = 15pF$ (including probe capacitance)

SINE OUTPUT



ENVIRONMENTAL and MECHANICAL SPECIFICATIONS APPENDIX C

FREQUENCY CONTROL PRODUCTS

GROUP 1	
Temperature Cycling	±5 ppm max., -55°C to +85°C, 3 cycles, 2 hours max., reference to 25°C ±3°C.
Thermal Shock	+85°C and -55°C. Exposure time at extreme temperature for 5 min., 3 cycles.
Vibration	Frequency with an amplitude of 1.5mm sweeping between 10Hz to 55Hz within 1 minute for 2 hours minimum on each axis (X, Y, Z).
Drop Test	Natural drop on a hard wood board at 75cm and 1 m, 3 times.
Humidity	85% RH at +85°C, 96 hours minimum
Marking Permanency	Dip units in solvent, 10 strokes with brush, 3 times.
Fine Leak Test	Helium leak, less than 2×10^{-8} atm.cc /sec.
Gross Leak Test	100% in De-ionized H ₂ O or Perfluoro-carbon for 60s min. at 125°C
Solderability	Dip in solder (230°C ±5°C) for 5 seconds. More than 95% of surface being tested should be coated uniformly with solder.
Lead Bend	Will withstand maximum bend of 90° reference to base for 2 bends.
GROUP 2	
Temperature Cycling	±5 ppm max., -40°C to +85°C at 95% RH ten times for 24 hours, 3 cycles then for 2 hours at 25°C ±3°C.
Thermal Shock	+85°C and -40°C. Exposure time at an extreme temperature for 5 min., 3 cycles.
Vibration	Frequency with an amplitude of 1.5mm sweeping between 10Hz to 55Hz within 1 minute for 2 hours minimum on each axis (X, Y, Z).
Drop Test	Natural drop on a hard wood board at 75cm, 3 times.
Humidity	85% RH at +85°C, 96 hours minimum
Marking Permanency	Dip units in solvent, 10 strokes with brush, 3 times.
Fine Leak Test	Helium leak, less than 2×10^{-8} atm.cc/sec.
Gross Leak Test	100% in De-ionized H ₂ O or Perfluoro carbon for 60s min. at 125°C
Solderability	Dip in solder (230°C ±5°C) for 5 seconds. More than 95% of surface being tested should be coated uniformly with solder.
GROUP 3	
Drop Test	±5 ppm max. with natural drop on a hard wood board at 75cm, 3 times or shock test of 3000g x 0.3ms x ½ sine wave, 3 directions.
Marking Permanency	Dip units in solvent, 10 strokes with brush, 3 times.
Sealing	1 x 10 ⁻² µPa.m ³ /s max.
Soldering	Lead wires should be soldered within 105 with the iron heated to a temperature no higher than 270°C

GROUP 4 (INTERNAL CRYSTAL)	
Temperature Cycling	±5 ppm max., -55°C to +85°C, 3 cycles, 2 hours max., reference to 25°C ±3°C.
Thermal Shock	+85°C and -55°C. Exposure time at extreme temperature for 5 minutes, 3 cycles.
Vibration	Frequency with an amplitude of 1.5mm sweeping between 10Hz to 55Hz within 1 minute for 2 hours minimum on each axis (X, Y, Z).
Drop Test	Natural drop on a hard wood board at 75 cm, 3 times.
Humidity	85% RH at +85°C, 96 hours minimum
Marking Permanency	Dip units in solvent, 10 strokes with brush, 3 times.
Fine Leak Test	Helium leak, less than 2×10^{-8} atm.cc/sec.
Gross Leak Test	100% in De-ionized H ₂ O or Perfluoro carbon for 60s min. at 125°C
Solderability	Dip in solder (230°C ± 5°C) for 5 seconds. More than 95% of surface being tested should be coated uniformly with solder.
Lead Bend	Will withstand maximum bend of 90° reference to base for 2 bends.
GROUP 5	
Temperature Cycling	Soak for 30 minutes at -55°C and +85°C for 5 times, release to 25°C for 1 hour prior to measurement.
Thermal Shock	Keep at 80°C ±5° for 96 ±4 hours, release to 25°C for 1 hour prior to measurement. Keep at -30°C ±5° for 96 ±4 hours, release to 25°C for 1 hour prior to measurement.
Vibration	Frequency with an amplitude of 1.5mm sweeping between 10Hz to 55Hz within 1 minute for 2 hours minimum on each axis (X, Y, Z).
Drop Test	Natural drop on a concrete floor at 1m for 3 times.
Humidity	90% RH at +40°C, 96 ±4 hours.
Solderability	Dip in solder the leads no closer than 1.5mm at (350°C ± 10°C) for 5 ± 1 seconds. More than 95% of surface being tested should be coated uniformly with solder.
Oscillation Frequency change:	±0.3% Max.
Capacitance Change:	±20% Max.

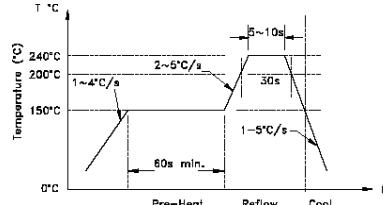


Fig. 1

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ENVIRONMENTAL and MECHANICAL SPECIFICATIONS

FREQUENCY CONTROL PRODUCTS

GROUP 6		Temperature cycling (Continued)	After 30 minutes at this temperature, resonator shall be returned to -55°C again. After 100 cycles, resonator shall be returned to room temperature. Then release the resonator into the room condition for 1 hour prior to measurement.
Temperature cycling	Subject the resonator to a low temperature of -55° ±2°C for 30 minutes, followed by a high temperature of +85°C ±2°C. Cycling shall be replaced 10 times. Then release the resonator into the room condition for 1 hour prior to measurement.	Salt spray	After being placed in a chamber at 35° ±2°C, density 5 ±1% (by weight) for 48 hours and then being placed in natural condition for 1 hour, resonator shall be measured.
High temperature	Subject the resonator to 85° ±2°C (125°C for automotive) for 1,000 hours ±12 hours. Then release the resonator into the room condition for 1 hour prior to measurement.	Sulfuration	After being placed in a chamber with 1000ppm sulfur density for 24 hours, and then being placed in natural condition for 1 hour, resonator shall be measured.
Low temperature	Subject the resonator to -55°C for 1,000 hours ±12 hours. Then release the resonator into the room condition for 1 hour prior to measurement.		
Humidity	Subject the resonator to 60° ±2°C at 90 -95% RH for 1,000 hours ±12 hours. Then release the resonator into the room condition for 1 hour prior to measurement.		
Drop test	Drop the resonator onto concrete floor from the height of 1.0m at 3 times. No visible damage.		
Soldering heat resistance	Dip the leads 2.0 ~ 2.5mm depth from bottom of the resonator body for 10 ±1s at 260°C ±5°C solder bath.		
Washability	Ultrasonic wash 1 minute at 60°C in TCE, IPA, and DI water (Frequency 28kHz, Output 20W/L).		
Vibration	Apply the resonator to vibration for 2 hours in the X, Y, Z axes with the amplitude of 1.5mm. The vibration shall be varied uniformly between the limits and returned to 10Hz in 1 minute.		
Terminal strength	Apply 1kg pulling force along with the direction of leads for 10 ±1s. Lead shall be subjected to stand against 90° bending in the direction of thickness. No visible damage.		
Solderability	Dip the leads into the solution of 25% rosin and ethyl alcohol and then into the solder bath (60/40 Sn/Pb) for 2 ±0.5 s at 235° ±5°C. Then release the resonator into the room condition for 1 hour prior to measurement. 95% min. lead terminals shall be wet with solder.		
For SMD			
Soldering heat resistance	Reflow: Preheat 140° ~ 160°C for 1 min. max. temperature 230° ±5°C and above 200°C for 20s. max. and then leave in natural condition for 1 hour before measurement.		
PCB bend strength	After soldered on the PCB, press it by up to 1mm and keep it for 5s, 5 times repeatedly.		
For Automotive			
Temperature cycling	After being kept at room temperature, resonator shall be placed at -55°C. After 30 minutes at this temperature, resonator shall be taken out at room temperature for 15 min. then placed at temperature of +85°C.		
Requirements: Oscillating frequency deviation (from initial value): < ±0.3%		Requirements: Oscillating frequency deviation (from initial value): < ±10ppm	
Capacitance change: < ±20%		Requirements: Capacitance change: < ±20%	

Requirements: Oscillating frequency deviation (from initial value): < ±0.3%
Capacitance change: < ±20%

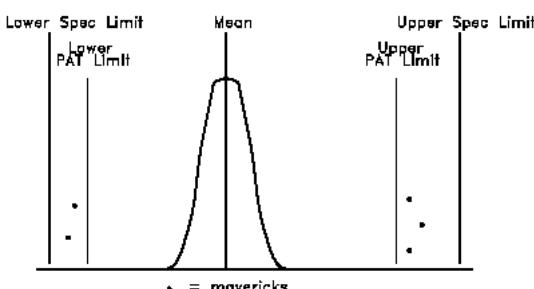
ENVIRONMENTAL and MECHANICAL SPECIFICATIONS

QUALITY NOTES

Abracon has been awarded ISO9000/QS9000 certification. In the early design and development stage, we conduct extensive qualification tests to ensure that each of the units manufactured will meet the minimum reliability conditions as specified in the control drawings. Reliability tests include physical dimensions, hermeticity, solderability, humidity, operating life, heat and cold, thermal shock, aging, resistance to solder heat, flammability, lead strength, residual gas analysis, reflow. We will apply customer's test plan if it is more stringent than Abracan test plan.

Products have been 100% inspected and tested with Statistical Process Control (SPC) with CpK of 1.33 to make sure that our products meet quality standards. Our quality goals are:

- 3 Total Customer Satisfaction
- 3 Six Sigma Concepts
- 3 100% on-time delivery
- 3 8D/10-step Problem Solving Methodology
- 3 Potential Failure Mode and Effects Analysis (FMEA) and Quality Control Plan.
- 3 SPC in manufacturing processes to minimize variation between lots
- 3 Early participation in customer programs
- 3 Product Part Approval Process (PPAP)



CALCULATION OF FIT AND MTTF (or MTBF)

Failure rate (λ): Measure of failure per unit of time. The life failure rate is based on the exponential life distribution.

Failure in Time (FIT): Measure of failure rate in 10^9 device hours, e.g. 1 FIT = 1 failure in 10^9 device hours.

Total Device hours (TDH): The total number of units in life test or operation multiplied by the time of test or operation.

Mean Time To Failure (MTTF): Mean of the life distribution for the population of devices under operation or expected lifetime of an individual, $MTTF = 1/\lambda$, which is the time where 63.2% of the population has failed. Example: For $\lambda = 10$ FITs, $MTTF = 100$ millions hours.

Confidence Level (CL): Probability level at which population failure rate estimates are derived from sample life test. The upper confidence level interval is used (60%).

Acceleration Factor (AF): λ A constant derived from experimental data which relates the times to failure at two different stresses.

1

$$\text{FAILURE RATE } (\lambda) = \frac{1}{TDH \times AF}$$

Where: TDH = No. of devices x hours at elevated temperature
AF = Acceleration factor

$$\text{Acceleration factor} = e^{-\frac{EA}{k} \left[\left(\frac{1}{T_1} - \frac{1}{T_2} \right) \right]}$$

Theta = 60% Upper Confidence Limit

R = Number of Failures (see table)

EA = 0.4eV

K = Boltzmann constant 8.62×10^{-5} eV/K

T1 = 298K (25°C)

T2 = 358K (85°C)

χ^2 = Chi square value (see table)

Chi Square Distribution Function (60% Upper Confidence Level)

NUMBER OF FAILURES	χ^2 VALUE	NUMBER OF FAILURES	χ^2 VALUE	NUMBER OF FAILURES	χ^2 VALUE
0	1.833	4	10.47	8	18.87
1	4.045	5	12.58	9	20.95
2	6.211	6	14.68	10	23.03
3	8.351	7	16.78		

$$\text{FAILURE IN TIME (FIT)} = (\lambda) \times 10^9$$

$$\text{MEAN TIME TO FAILURE (MTTF)} = 1/\lambda \times 10^9 \text{ hours}$$

Example: No. of devices: 100, Total hours = 1,000 hours, Temperature (T2) at 125°C = 398K, zero failure

Device hours (TDH) = $100 \times 1,000 = 100,000$ device hours

Acceleration factor (AF) = 49.3

$$\text{Failure rate } (\lambda) = 202 \times 10^{-9}$$

$$\text{Failure in time (FIT)} = 202 \text{ FIT}$$

Mean time to failure (MTTF) = 4.95 million hours or Mean time between failure (MTBF)

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VALUE ADDED OPTIONS

APPENDIX D

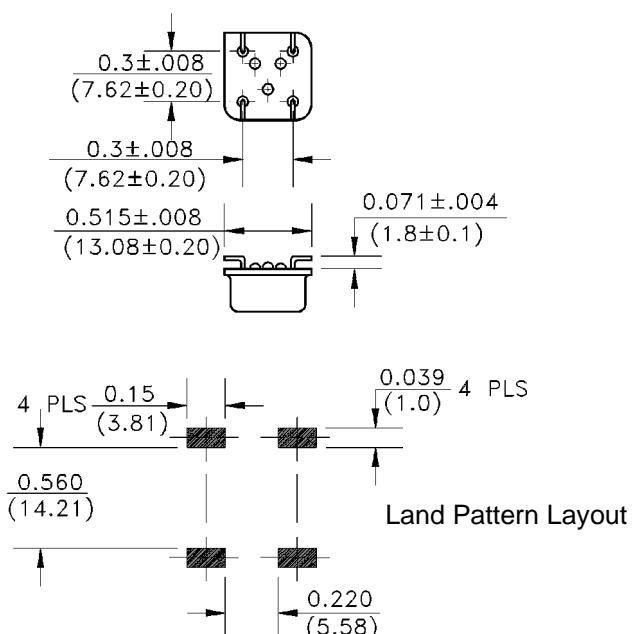
QUARTZ CRYSTALS

MIDDLE THIRD-LEAD OPTION L2	HC51U PACKAGE OUTLINE
VINYL SLEEVE OPTION V	INSULATOR TAB OPTION I
THIRD-LEAD OPTION L, L1	THIRD-LEAD OPTION L3

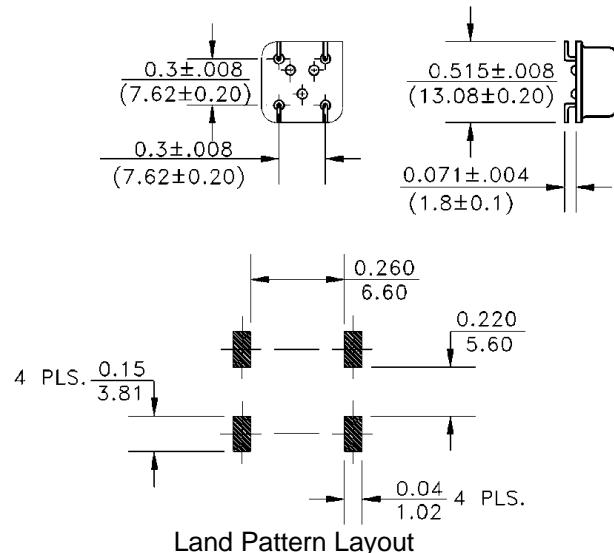
VALUE ADDED OPTIONS

QUARTZ CRYSTALS OSCILLATORS

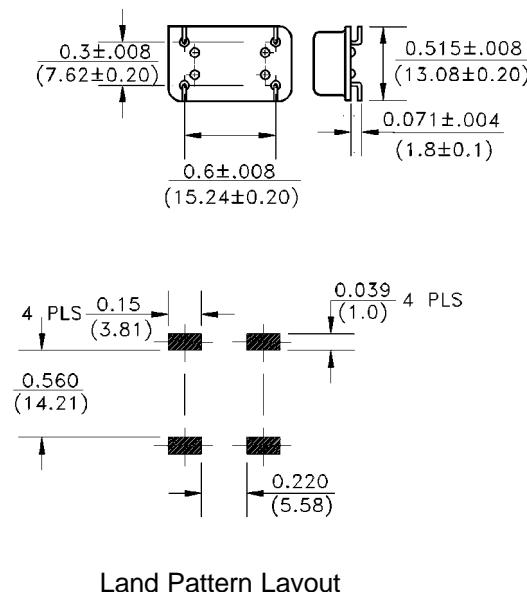
**GULL-WINGED FOR HALF-SIZE DIP OSCILLATORS
OPTION G, GHT**



**GULL-WINGED FOR HALF-SIZE DIP OSCILLATORS
OPTION G2**

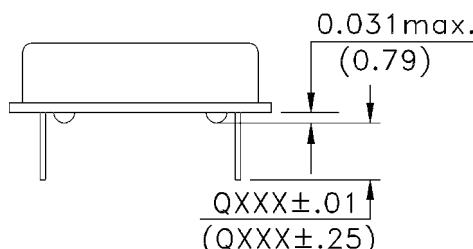


**GULL-WINGED FOR FULL-SIZE DIP OSCILLATORS
OPTION G, GHT**



**TRIMMED LEADS OPTIONS FOR DIP OSCILLATORS
OPTION QXXX (VALUE IN INCH) See Table**

CODES	TRIMMED LENGTH Inches (mm)
Q10	0.10 (2.54)
Q15	0.15 (3.81)
Q20	0.20 (5.08)
Q25	0.25 (6.35)
Q30	0.30 (7.62)



Dimensions: Inches (mm)

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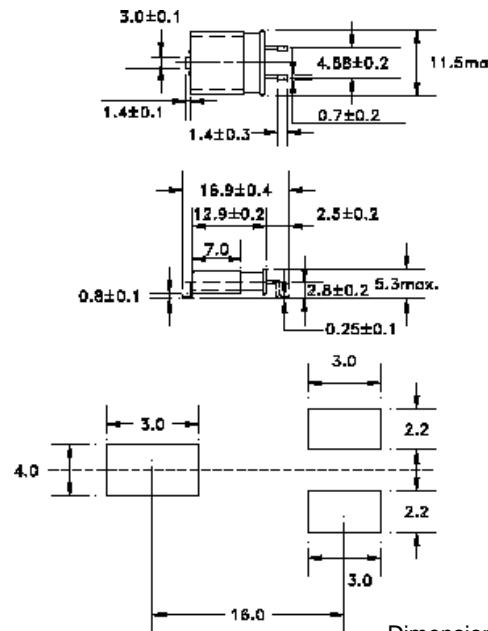
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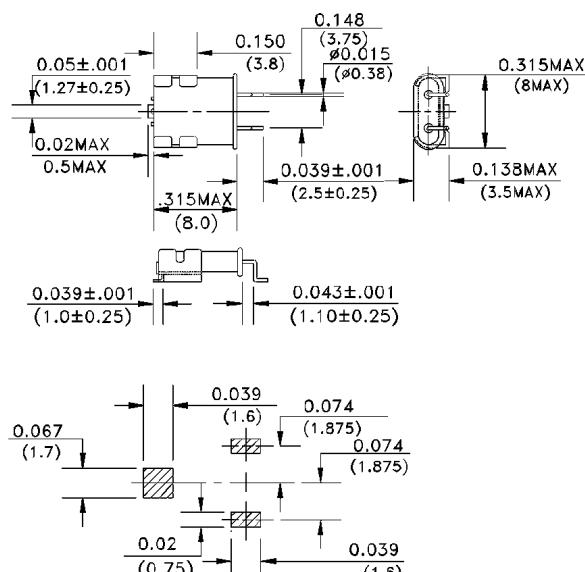
VALUE ADDED OPTIONS

QUARTZ CRYSTALS

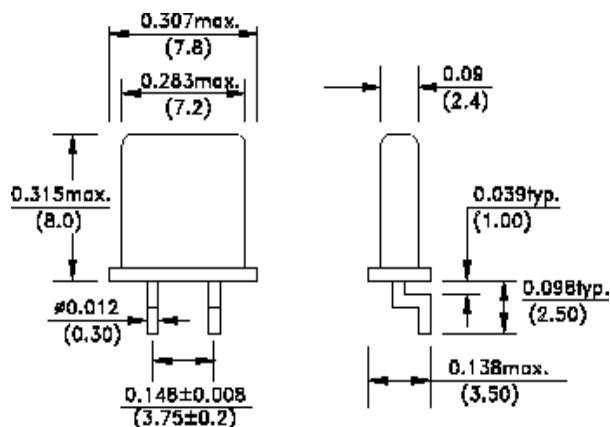
METAL JACKET FORMED LEADS HC49/U OPTION MJ



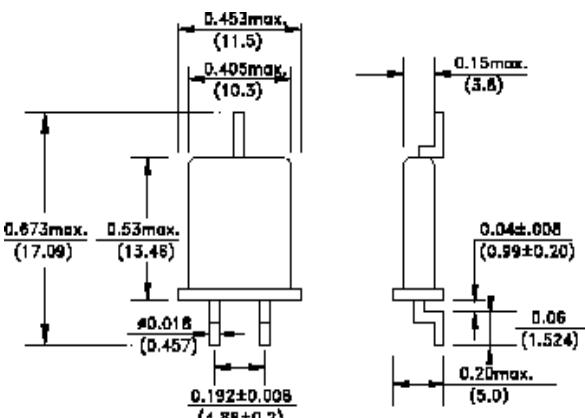
METAL JACKET FORMED LEADS UM-1 OPTION MJ



FORMED LEADS UM-1 OPTION M



FORMED LEADS HC49/U OPTION M



Dimensions: Inches (mm)

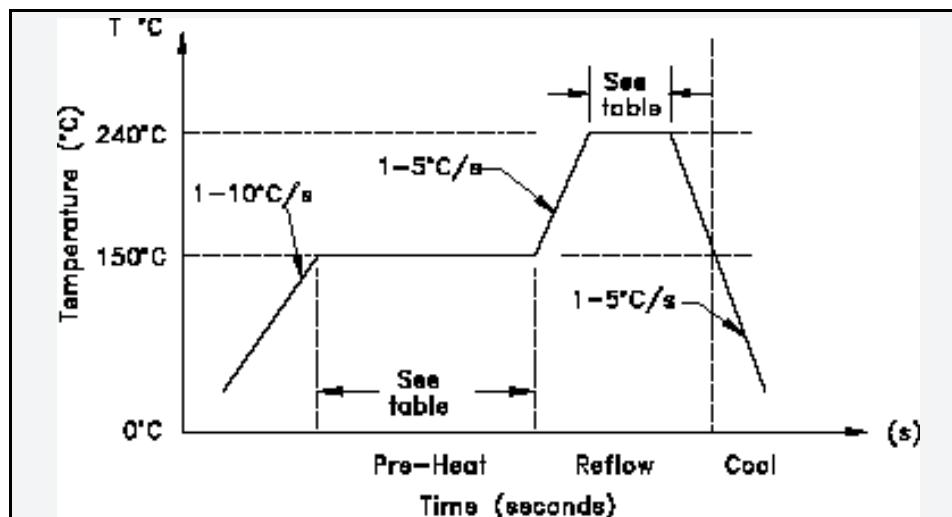
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SURFACE-MOUNT PRODUCTS



Abracor Series	Recommended Pre-Heat time	Recommended Reflow temperature/time
Ceramic Crystals, ABC, ABLS, ABM, ABMC Series Ceramic Oscillators, ASF, ASG, ASL, ASV Series Ceramic Filters, ASCF Series Ceramic SAW Resonator, Filter, ASSF, ASSR Series	60 ~ 120 sec. Max.	240°C max. for 10 sec. Max. , 2 times or 230°C max. for 80 sec. Max. , 1 time.
Plastic Molded Crystals, ABSM, ABSM2, ABS13, ABS15, ABS25 Reflowable Type Cylindrical Crystals, AB26TR, AB308TR Plastic Molded Oscillators, ASM Series	60 ~ 90 sec. Max.	240°C max. for 10 sec. Max. , 2 times or 230°C max. for 80 sec. Max. , 1 time.
All SMD TCXOs, VCTXOs, ASTX, ASVTX Series	55 ~ 70 sec. Max.	240°C max. for 10 sec. Max. , 1 times or 220°C max. for 40 sec. Max. , 1 time.
Gull-Wing HT DIP series *	55 ~ 70 sec. Max.	240°C max. for 10 sec. Max. , 1 times or 220°C max. for 40 sec. Max. , 1 time.

* Not highly recommended, Use with extreme precaution.

Solder-cream with typical melting temperature at 180°C shall be used in IR reflow method. Heating the package more than the recommended temperature may deteriorate the characteristics or damage the product.

RECOMMENDED HANDLING

APPENDIX F

QUARTZ CRYSTALS OSCILLATORS

I. ELECTRICAL

1) Supply voltage

Most of Abracon oscillators utilize a CMOS technology ASIC chip with extreme ESD sensitivity. When apply power to the oscillator unit, be sure to check the polarities before connecting to the terminals. Reversed polarity connections may cause the unit to be damaged electrically (dead) or mechanically (burn, color change). Pin 1 is usually identified by a black dot marked on cover.

Be sure to apply voltage to the oscillator not exceeding the maximum specified value which is typically 7Vdc max. for most CMOS IC. Applying under rating voltage could result to no (unstable) oscillation.

Although many metal can oscillators have built-in bypass capacitors, it is a good practice to add an external bypass capacitor $0.01\mu F$ near the Vdd terminal. The external capacitor is used as an over impressed voltage and overcurrent protective device.

Figure 1 shows a typical layout for a surface-mount crystal oscillator.

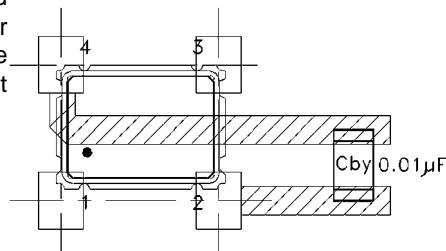


Figure 1

2) Load impedance

Oscilloscope impedance shall be greater than $1 M\Omega$ with probe capacitance less than $15pF$. The load applied shall include probe capacitance. All lead length should be kept as short as possible especially ground trace. Output trace from oscillator output to the load (next IC) shall be kept short and avoided layout in parallel or cross with another hot signal trace. Stray capacitance and inductance have major effects on output impedance of the oscillator unit and shall be minimized.

3) Output frequency

Output frequency shall be measured with a precision frequency counter using a reference external time base. Make sure to stabilize the crystal oscillator (warm-up) before recording the final frequency value, especially on high frequency and high current units.

II. MECHANICAL

1) Vibration and shock

Do not apply or cause sudden shock and vibration exceeding its maximum specifications to the unit. Severe drop or being hit with a hard object could damage the unit

electrically and mechanically. Please test the unit if dropped before assembling or using.

2) Mounting

The following precautions shall be applied during mounting through-hole crystal oscillators:

- Do not force spreading the terminals into socket or PCB holes. This will avoid breaking the glass insulation on terminals.

- Do not apply excessive soldering heat or soldering duration on terminals.

- When bending leads for surface-mount, be very careful to use appropriate tool keeping a safe distance between the terminal base and the bent area.

The following precautions shall be applied to all surface-mount oscillators:

- Use the appropriate reflow condition as recommended on the unit specification. Please make sure to not exceed the peak temperature, its maximum duration, the number of exposures, the rate of temperature change vs. time, etc.

3) Cleaning

Use only recommended solvents in order to avoid discoloration or damage on ink marking permanency. Some solvents, which contain Chlorine, may cause some color discoloration on some metallic cover.

Do not exceed the maximum recommended temperature when cleaning.

III. PACKAGING

Although an anti-static protection circuit is built-in the ASIC, excessive static electricity level may damage the unit. Abracon uses Non-conductive packing materials for all oscillators. By sure to ground with ESD strap before handling the device.

IV. HANDLING UNUSED TERMINALS

Some Abracon oscillators include Tristate function.

Although there is an internal pull-up resistor to prevent floating, it is recommended to terminate the tristate terminal to Vdd with a resistor of $100k\Omega$ in series.

V. STORING

Please store all units at normal temperature and humidity. High humidity may cause deterioration to units. Avoid storing over a long period. Please perform visual and electrical inspections before using once the units are stored over a long period.

RECOMMENDED HANDLING

QUARTZ CRYSTALS, CERAMIC RESONATORS, SAW FILTERS

I. ENVIRONMENTAL AND MECHANICAL

Vibration:

Abracon products are designed and manufactured to handle standard vibration conditions. Please take extreme precautions to ensure that products are not subjected to vibrations other than the ones specified in our appendix C. Vibration can damage the product by cracking or breaking the quartz wafer.

Shock:

Abracon products are designed and manufactured to handle standard mechanical drop shock from 75cm on a wooden board or equivalent to 1,000g. Please take extreme precautions to ensure that products are not subjected to vibrations other than the ones specified in our appendix C.

Thermal shock:

Thermal shock is a test to measure the reliability of the products under rapid temperature changes. Abracon products are designed and manufactured to handle up to 1,000 hours of thermal shock from -40°C to 85°C. Please refer to appendix C for thermal shock specifications.

Humidity:

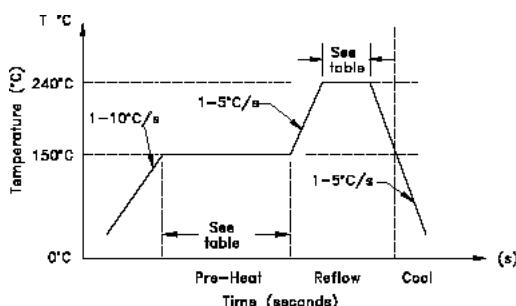
Avoid dew condensation and high humidity. Abracon products are designed to meet standard humidity at 85% relative humidity at 85°C. Please store products in appropriate heat and humidity to guarantee the shelf life.

Soldering:

Unless otherwise specified, soldering should be performed on terminals at 260°C for 10s maximum. Do not apply direct soldering heat on crystal package body since it could damage the unit.

Reflow:

Abracon surface-mount products are designed and manufactured to meet standard IR reflow method. However, duration of the reflow stages may vary from part to part. Please check specifications for details.



Duration of reflow stages can be found in appendix E.

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NOTE: Left blank if standard • All specifications and markings subject to change without notice

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E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com

Cleaning:

Avoid ultrasonic cleaning as it may cause damage to the product. Banned solvents could affect marking permanency or cause discoloration on products. Please take extra precautions when cleaning ceramic resonators.

Lead bending and cutting:

Be careful not to apply too much pressure when bending leads. Try to use a tool to clamp the leads then bend at a 90° angle with minimum clearance from body. Do not apply excessive force to cut or bend leads. Doing so could crack the glass insulation or resin seal and cause leak.

II. ELECTRICAL

Operating temperature:

Products should be used and operated within temperature limits as specified in the catalog.

Storage temperature:

Products should be stored within temperature limits as specified in the catalog. Storage temperature can be between 10° to 45°C.

Drive level:

Products should be operated within maximum power as specified in the catalog. Excessive drive level could break the crystal wafer or affect long-term and short-term stability.

III. PACKAGING

Packaging:

Although quartz crystals, ceramic resonators, and crystal filters are not ESD sensitive, we recommend packaging in anti-static bag for better protection. We use various packaging methods such as anti-static tube, tray, foam, tape and reel, ammo packing on Abracon products. We recommend opening packaging tubes or bags with care to avoid damage to products.

IV. LAYOUT

We recommend to layout crystals, resonators, or SAW products close to the chipset inputs. Avoid long and coupling traces. Avoid multilayer boards to avoid stray inductance and capacitance. Those items could result to a frequency error or affect circuit start-up.

STANDARD MARKINGS

APPENDIX G

SURFACE-MOUNT QUARTZ CRYSTALS

ABC2

Line 1: XX.XXX or X.XXXX (First 5 digits of frequency)
Line 2: P/N YYW W (Date code, Year and Week)

Example:

4.000MHz **4.0000**
15th week, 2002 **ABC2 0215**
14.31818MHz **14.318**
4th week, 2003 **ABC2 0304**

ABLS SERIES, ABL SERIES, ABSM, ABSM2

ABSM3, ABSM5 SERIES

Line 1: A TUH ZY R
A Abracor identifier
TUH Frequency
T = First "ten" digit of frequency
U = First "unit" digit of frequency
H = First "tenth" digit of frequency

Z: Month letter (A to L)

Y: Last digit of year

R Traceability code (character A to Z)

Example:

14.31818MHz, January 2002
A143A2R
4.0000MHz, May 2003
A040E3R

ABM2, ABM4 SERIES, ABMM SERIES

Line 1: TUH
Line 2: P/N ZY X
TUH Frequency
T = First "ten" digit of frequency
U = First "unit" digit of frequency
H = First "tenth" digit of frequency

P/N Part number

Z: Month letter (A to L)

Y: Last digit of year

X: Traceability code (A to Z)

Example:

10.000MHz **100**
Feb. 2002 **ABM2 B2E**
14.31818MHz **143**
March 2002 **ABM4A C2S**

ABM7, ABM8, ABM9, ABM3 SERIES

Line 1: TUH
Line 2: A ZY X

A Abracor identifier
TUH Frequency
T = First "ten" digit of frequency
U = First "unit" digit of frequency
H = First "tenth" digit of frequency

Z: Month letter (A to L)

Y: Last digit of year

X: Traceability code (A to Z)

Example:

20.00MHz **200**
Feb. 2002 **A B2**

ABS13, ABS15

Line 1: 32CYZ

Y: Last digit of year

Z: Month (1 to 9 for Jan. to Sept.)(X to Z for Oct. to Dec.)

AB308R, AB310R

Line 1: XX.XCZY
XX.X : First 3 digits of Frequency
Z: Month letter (1 to 9 , X to Z)
Y: Last digit of year

ABS25

Line 1: 327ZY

327: First 3 digits of Frequency
Z: Month letter(1 to 9, X to Z)
Y: Last digit of year

Example:

32768kHz **327A2 (Jan.2002)**
40000kHz **400B3 (Feb. 2003)**

AB26TR SERIES

Line 1: XXXXX or 32CYZ

XXXXX Frequency in Hz
Y: year ex: 2 2002
Z: Month letter (1 to 9, X to Z)
Example: 2 (Feb.)

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E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com

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STANDARD MARKINGS

LEADED QUARTZ CRYSTALS, CRYSTAL FILTERS

AB

Line 1: ABRACON
Line 2: XXX.XX - 20F
Line 3: AB YYWW

XX X.XX First five digits of frequency.
20 Load capacitance option (*)
(Left blank if standard)
F Fundamental F or FB
(Left blank if standard)
YY Date code, last two digits of year
WW Week (01 to 53)

Example:

20.000MHz	ABRACON	30.000MHz	ABRACON
15th week, 2002	20.000-20	22th week, 2002	30.000-FB
20pF	AB 0215	Fundamental BT	AB 0222

AB308, AB310

Line 1: XX.XXX

XX.XXX Frequency (First 5 digits)

Example:

4.000MHz = **4.0000** 66.00MHz = **66.000**

ABL SERIES (SEE ABLS)

AB26T

Line 1: XXXXXX or SYZ1

XXXXXX: Frequency in Hz (ex. 32.768)
Y : Last digit of year (ex. 2 for 2002)
Z : Month (1 to 9, X to Z)

ABU SERIES

Line 1: TUH
Line 2: P/N ZY X
TUH Frequency (see note for frequency >=100MHz)
T = First "ten" digit of frequency
U = First "unit" digit of frequency
H = First "tenth" digit of frequency
P/N ABU, ABU4, ABU5
Z Month letter (A to L)
Y Last digit of year
X Traceability code.(A to Z)

Example:

81.745MHz	817	125MHz	125.0
Feb. 2000	ABU B0E	March 2001	ABU4 C1E

AB38T

Line 1: XXXXX

XXXXX Frequency in Hz (or lot number)

Example:

32.768kHz = **32768**

ACF, ASCF SERIES

Line 1: XX.X

Line 2: UXX ZY
XX.X : Frequency in MHz (ex. 21.4)
XX : Suffix in P/N
ZY : Date code (Month, Year)

CERAMIC RESONATORS

LXZT

Line 1: XXXXK

XXXX Frequency in kHz

Examples:

192kHz	1250K
192K	1250K

HXZT, ASZT, ACR, ASCR

Line 1: XX.XXM

XX.XX Frequency in MHz

Examples:

4.00MHz = **4.00M** 8.00MHz = **8.00M** 16.0MHz = **16.0M**

HWZT, AWCR, AWSZT, AWSZR

Line 1: XX.XX MZY

XXX From Part Number in specification pages.

Example:

ZY: Date code (Z, month A to Z)
(Y, year) *

Example: 4.00MA2 (Jan. 2002)

Note: * Date code may not appear on small quantity samples.

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STANDARD MARKINGS

LEADED VCXOS, VCTXOS AND SMD VCTXOS

ACH, ACO, ACOL, ACHL, ACT, AHT, ACOL1, ACHL1, ADCO, ADCO1, ACPE, ACPEL, ACOP, ACHP

Line 1: ABRACON

Line 2: XXX.X - CSA or XXX.XXXXX (see note *)

Line 3: • P/N YYWW

XXX.X First 3 digits of frequency (if following with options)

XXX.XXXXX Full frequency with 8 digits and a period max.

Note * Add a K for kHz for low frequency.

C Option for frequency stability (Left blank if standard)

S Option for symmetry (Left blank if standard)

A Option for tristate (Left blank if standard)

• Pin 1 identifier

P/N Part Number

YY Last two digits of year (03 for 2003)

WW Week of year (01 to 53)

Example:

107.5MHz ABRACON

±50ppm, Tristate 107.5 - A

• ACO 0245

66.666MHz ABRACON 32.768kHz ABRACON
66.6666 OR 32.768K - A
• ACOL0307 • ACHL 0212

ACVX1220, ACVX1220L, ACVX1222, ACVX1222L, ACVX1240, ACVX1224

Line 1: ABRACON

Line 2: XXX.X - CSN15 or XXX.XXXXX

Line 3: P/N

Line 4: • YYWW

XXX.X First 3 digits of frequency (if following with options)

XXX.XXXXX Full frequency with 8 digits and a period max.

C Option for frequency stability (Left blank if standard)

S Option for symmetry (Left blank if standard)

N15 Option for pulling (Left blank if standard)

• Pin 1 identifier

P/N Part Number

YY Last two digits of year (02 for 2002)

WW Week of year (01 to 53)

Examples:

27MHz ABRACON

±25ppm, 45/55% 27.0 - RSN15

±150ppm pull ACVX1222

• 0227

66.666MHz ABRACON

66.6666

ACVX1220L

• 0314

AHVX1025, AHVX1025L

Line 1: ABRACON

Line 2: XXX.X - CN15 or XXX.XXXXX

Line 3: • P/N YYWW

XXX.X First 3 digits of frequency (if following with options)

XXX.XXXXX Full frequency with 8 digits and a period max.

C Option for frequency stability (Left blank if standard)

N15 Option for pulling (Left blank if standard)

• Pin 1 identifier

P/N AHVX1025 (Marked as **AHVX**) or
AHVXL1025 (Marked as **AHVXL**)

YY Last two digits of year (02 for 2002)

WW Week of year (01 to 53)

Examples:

40MHz	ABRACON	52.0MHz	ABRACON
±25 ppm	40.0 - RN20	52.0000	
±200 ppm pull	• AHVX0202		• AHVXL0312

ACTX1018 SERIES, ASTX-01 to -07

Line 1: ABRACON

Line 2: XXX.X - E20 or XXX.XXXXX

Line 3: P/N

Line 4: • YYWW

XXX.X First 3 digits of frequency (if following with options)

XXX.XXXXX Full frequency with 8 digits and a period max.

E20 Option for stability vs. temperature

• Pin 1 identifier

P/N ACTX1018 or ASTX01 or ASVTX01 or ASTX03 or
ASVTX03 or ASVTX04 or ASTX06 or ASTX07

YY Last two digits of year (02 for 2002)

WW Week of year (01 to 53)

Examples:

10.0 MHz	ABRACON	20MHz	ABRACON
C30	10.0 - C30	E25	20.0 - E25
	ACTX1018		ASTX-01
	• 0212		• 0334

ASVTX-08, ASTX-09, ASVTX-09

Line 1: XX.XXX

Line 2: A08ZYX

XX.XXX Frequency in MHz

A08 Part Number A08 or A09

Z Month (A to L)

Y Last digit of year (2 for 2002)

X Traceability code (A to Z)



STANDARD MARKINGS

SURFACE-MOUNT QUARTZ CRYSTAL OSCILLATORS

ASFL, ASFL1

Line 1: **AXX.X J**

A Abraccon identifier
XX.X First three digits of frequency
J: Frequency Stability options

Example:

33.33MHz **A33.3R**

1.80MHz **A1.80C**

Pin 1 may be identified by a black dot or an asterisk *

ASL, ASV, ASL2, ASV2, ASG, ASGL

Line 1: **XX.X - FR**

Line 2: **P/N ZY X**

XX.X First three digits of frequency
F Operating temperature options
R Frequency stability option (Left blank if standard)
S Symmetry option (Left blank if standard)
P/N ASL or ASV
Z Month (A to L)
Y Last digit of year
X Traceability code (A to Z)

Example:

66.66MHz **66.6 - K**

Feb. 2002 **ASL B2S**

±30ppm

125MHz **125 - NH**

March 2003 **ASL C3S**

45/55%

Pin 1 may be identified by a black dot or an asterisk *

ASLP, ASVP

Line 1: **ALPX.XX** or **AVPX.XX** (w/o options) or **AX.XXLB**

Line 2: **6-digit date and traceability code**

XX.X First three digits of frequency
L Operating temperature options
B Frequency stability option (Left blank if standard)

Example:

66.66MHz **A66.6 - LR**

±25ppm **042104**

1.544MHz **AVP1.54**

050104

Pin 1 may be identified by a black dot or an asterisk *

ASM SERIES ASMP, ASMLP, ASML

Line 1: **ABRACON**

Line 2: **XX.X - RS**

Line 3: **ASM YYWW** or **ASM 250111** or
ASMLPZY or **ASMLPZY**

XX.X First three digits of frequency
R Frequency stability option (Left blank if standard)
S Symmetry option (Left blank if standard)
YY Last two digits of year or Y last digit of year
WW Week of year (01 to 53)
Y Z Month (A to Z)
250111 9 = Last digit of year (ex: 2 for 2002)
50 = Week of year
1 = Factory code
11 = Traceability lot code

Example:

50.0MHz, ±35ppm, 45/55%, year 2000, 34th week

ABRACON **ABRACON** **ABRACON**
50.0 - HS or **50.0 - HS** or **106.25**
ASM 0334 **ASM 252111** **ASMLP C2**

Pin 1 may be identified by a black dot or an asterisk *

ASML (MARKING OPTIONS)

Line 1: **ABRACON**

Line 2: **XX.X - RS**

Line 3: **ZY P/N** (see note *)

XX.X First three digits of frequency
R Frequency stability option (Left blank if standard)
S Symmetry option (Left blank if standard)
ZMonth A to L

Y Last digit of year (2 for 2002)

P/N * 4 characters maximum

ASMH • ASML •

Example:

66.66MHz, ±50ppm, 45/55%, year 2003, July

ABRACON

66.6 - CS

G3 ASML

Pin 1 may be identified by a black dot or an asterisk *

ASLV, ASVV

Line 1: **XX.X F30**

Line 2: **P/N ZYX**

XX.X First three digits of frequency
F30 Frequency vs temperature options
P/N ASLV or ASVV
Z Month (A to L)
Y Last digit of year
X Traceability code (A to Z)

Example:

27.0MHz **27.0 C20**

Tristate, Jan 2002 **ASLV A2K**

Pin 1 may be identified by a black dot or an asterisk *

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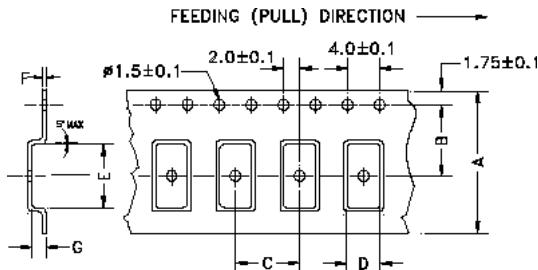
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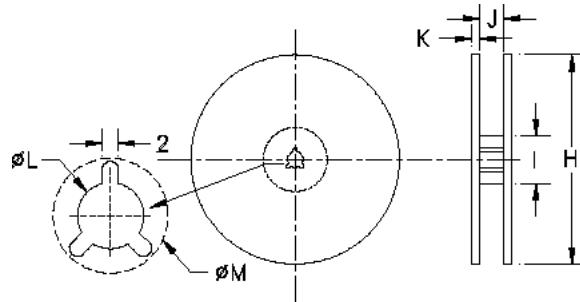


EMBOSSSED TAPE and REEL SPECIFICATIONS APPENDIX H

CRYSTALS, OSCILLATORS, CERAMIC RESONATORS, FILTERS



Dimensions: mm. Tape is compliant to EIA-481-A.



P/n	A	B	C	D	E	F	G	H	I	J	K	L	M
ABC2	24	11.5	12	5.9	12	0.4	2.4	330	100	25.5	2.0	13	21
ABLS, ABLS2	24	11.5	12	5.1	13	0.3	4.5	330	100	25.5	2.0	13	21
ABLS3	24	11.5	12	5.1	13	0.3	2.8	330	100	25.5	2.0	13	21
ABM2	16	7.5	8.0	4.8	8.4	0.3	2.3	330	100	16.4	2.0	13	21
ABM3	12	5.5	8.0	3.7	5.5	0.3	1.8	178	80	12.4	2.0	13	21
ABM3A, ABM3B	12	5.5	8.0	3.7	5.5	0.3	1.4	178	80	12.4	2.0	13	21
ABM4A, ABM4B	16	7.5	8.0	5.4	7.5	0.3	1.7	178	80	12.4	2.0	13	21
ABM3C	12	5.5	8.0	3.7	5.5	0.3	1.7	178	80	12.4	2.0	13	21
ABM7	12	5.5	8.0	4.1	6.5	0.3	1.4	250	80	12.4	1.6	13	21
ABM8	12	5.5	4.0	2.9	3.5	0.3	1.0	178	80	12.4	2.0	13	21
ABM9	12	5.5	4.0	2.9	4.4	0.3	1.0	178	80	12.4	2.0	13	21
ABMC2	24	11.5	12	5.2	12	0.3	2.3	330	100	24.4	2.0	13	21
ABMM, ABMM1	16	7.5	8.0	5.4	7.5	0.3	1.7	178	80	17.5	2.0	13	21
ABMM2, ABMM3	16	7.5	8.0	3.9	6.4	0.3	1.5	178	80	17.5	2.0	13	21
ABSM	24	11.5	8.0	5.3	13.4	0.4	4.8	330	100	25.5	2.0	13	21
ABSM2	24	11.5	12	4.8	12.8	0.4	3.9	330	100	25.5	2.0	13	21
ABSM3, ABSM5	24	11.5	12	5.1	13	0.3	5.5	330	100	25.5	2.0	13	21
ABS13	16	7.5	4.0	1.7	7.2	0.3	1.5	330	100	17.5	2.0	13	21
ABS15	16	7.5	8.0	3.4	7.2	0.3	1.75	330	100	17.5	2.0	13	21
ABS25	16	7.5	8.0	4.05	8.3	0.3	2.7	330	100	17.5	2.0	13	21
ASZT, ASCR	16	7.5	8.0	3.75	8.0	0.3	2.0	178	80	17.5	2.0	13	21
AWSZT, AWSCR (7230)	16	7.5	8.0	3.2	7.4	0.3	1.9	180/330	80	18	3.0	13	21
AWSZT, AWSCR (3731)	12	7.5	4.0	3.55	4.15	0.3	1.9	180/330	80	14	3.0	13	21
AWSZT, AWSCR (2520)	8.0	7.5	4.0	2.3	2.8	0.3	1.9	180/330	80	9.0	2.5	13	21
ASM, ASML, ASMP	24	11.5	12	10.1	14.3	0.4	5.0	330	80	25.5	2.0	13	21
ASF1	12	5.5	8.0	3.5	5.4	0.3	2.0	330	100	12.4	3.0	13	21
ASFL1, ASF1	12	5.5	8.0	3.5	5.4	0.3	1.4	330	100	12.4	3.0	13	21
ASG, ASGL	12	5.5	8.0	4.1	6.5	0.3	2.0	330	100	17.6	2.0	13	21
ASL, ASV, ASLP, ASLV	16	7.5	8.0	5.4	7.4	0.3	1.9	178	80	17.5	2.0	13	21
ASL2, ASV2	16	7.5	8.0	5.4	7.4	0.3	1.5	178	80	17.5	2.0	13	21
ASTX-01	24	-	16	11.7	12	0.3	4.5	330	80	29.5	2.0	13	21
ASTX-03, ASVTX-02	32	-	16	12.5	22.2	0.3	5.0	330	80	36.4	2.0	13	23
ASVTX-04, ASVTX-05	24	11.5	12	10.2	12.2	0.3	2.8	178	80	17.5	2.0	13	21
ASTX-06	24	11.5	12	7.4	9.5	0.3	2.7	178	80	17.5	2.0	13	21
ASVTX-07	16	7.5	8.0	5.4	7.5	0.3	2.2	178	80	17.5	2.0	13	21
ASVTX-08	16	7.5	8.0	5.4	7.5	0.3	2.2	178	80	17.5	2.0	13	21
ASVTX-09	12	5.5	8.0	3.7	5.5	0.3	1.9	178	80	12.4	1.6	13	21
ASCF21U, ASCF45U	16	7.5	8.0	5.4	7.5	0.3	1.7	178	80	17.5	2.0	13	21

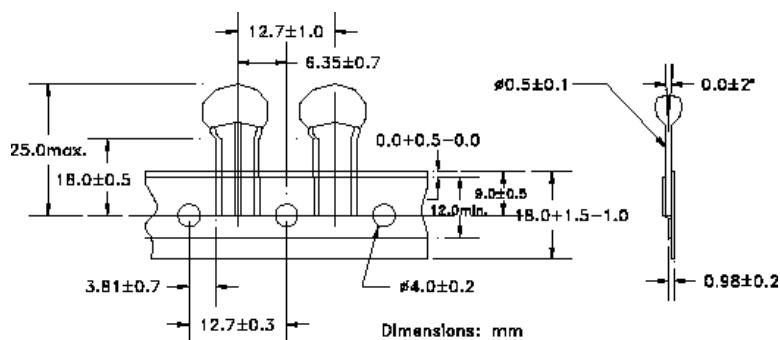
Tolerances:

- A ± 0.3 mm
- B ± 0.1 mm
- C ± 0.1 mm
- D ± 0.1 mm
- E ± 0.1 mm
- F ± 0.1 to ± 0.2 mm

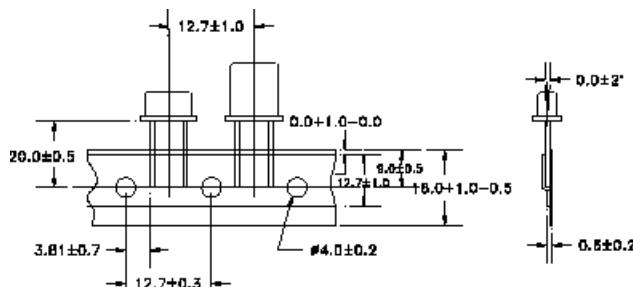
Dimensions of tape and reel subject to change without notice.

EMBOSSSED TAPE and REEL SPECIFICATIONS

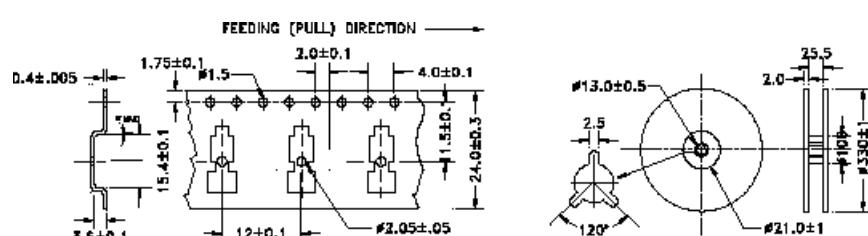
QUARTZ CRYSTALS, CERAMIC RESONATORS



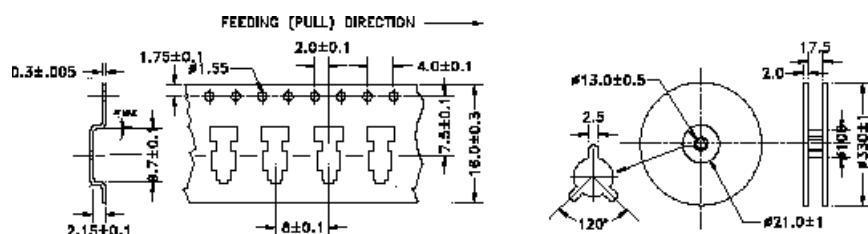
Tape and Reel AWCR/ HWZT/ ACR/ HXZT



Tape and Reel AB/ ABL



Tape and Reel AB308/ 310TR



Tape and Reel AB26TR

ABRACON IS
ISO 9001 / QS 9000
CERTIFIED

NOTE: Left blank if standard • All specifications and markings subject to change without notice

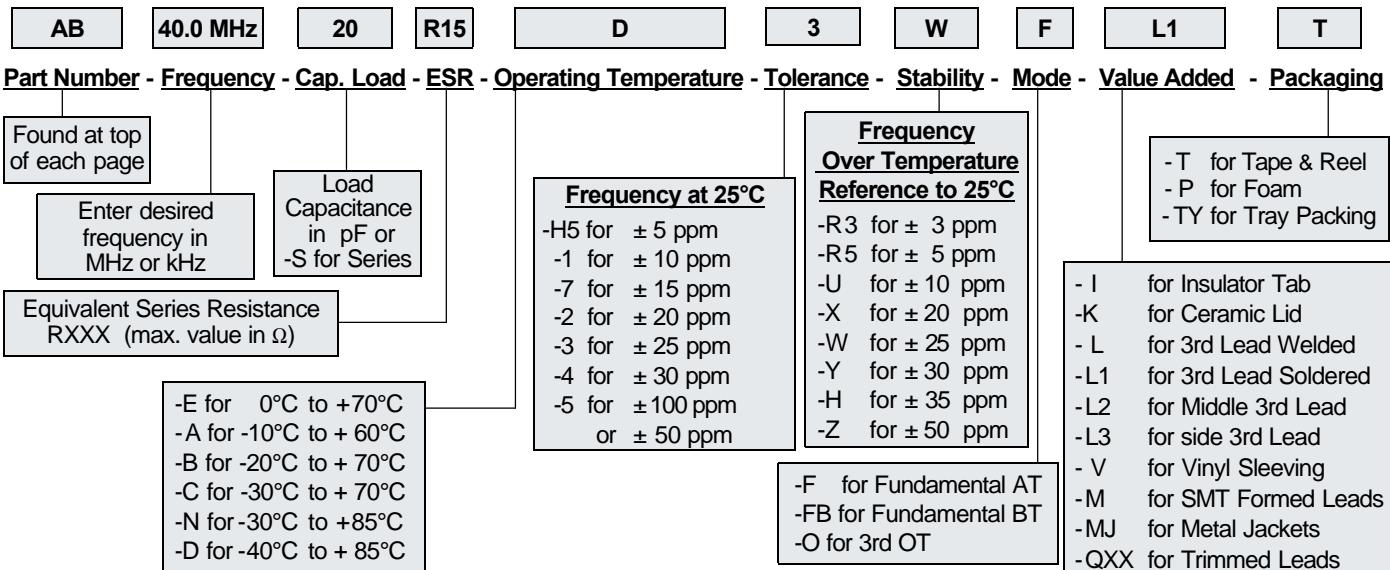
29 Journey • Aliso Viejo, CA 92656 • USA
(949) 448-7070 • FAX: (949) 448-8484
E-MAIL: abinfo@abracon.com • INTERNET ADDRESS: www.abracon.com

ABRACON
CORPORATION 119

PART NUMBERING GUIDE

ABRACON QUARTZ CRYSTALS

Explanation of Ordering Options for Quartz Crystals. EXAMPLE: AB-70.0 MHz-20-R80-D-3-W-O-L1-T

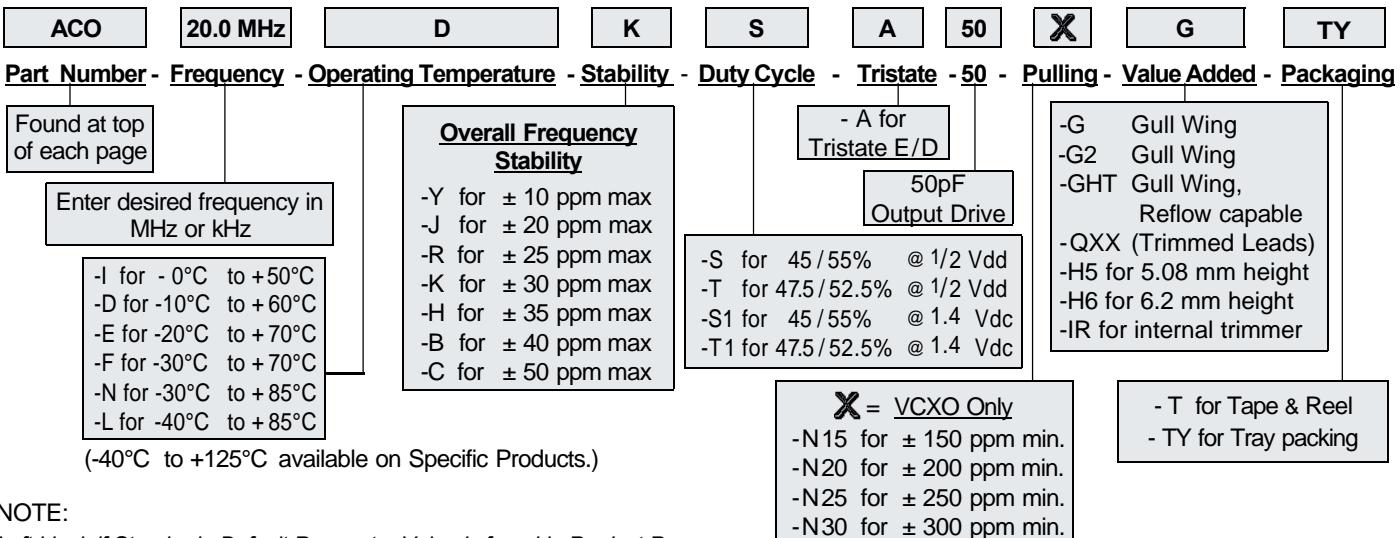


NOTE:

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ABRACON CRYSTAL OSCILLATORS

Explanation of Ordering Options for Crystal Oscillators EXAMPLE: ACO-20.0 MHz-D-K-S-A-50-G-TY



NOTE:

Left blank if Standard. Default Parameter Value is found in Product Pages.

The Part Numbering Matrix Guide is used for Reference ONLY.

Abracon does not guarantee the availability of all products with combination of parameters as specified above.

Please see details on product pages.

