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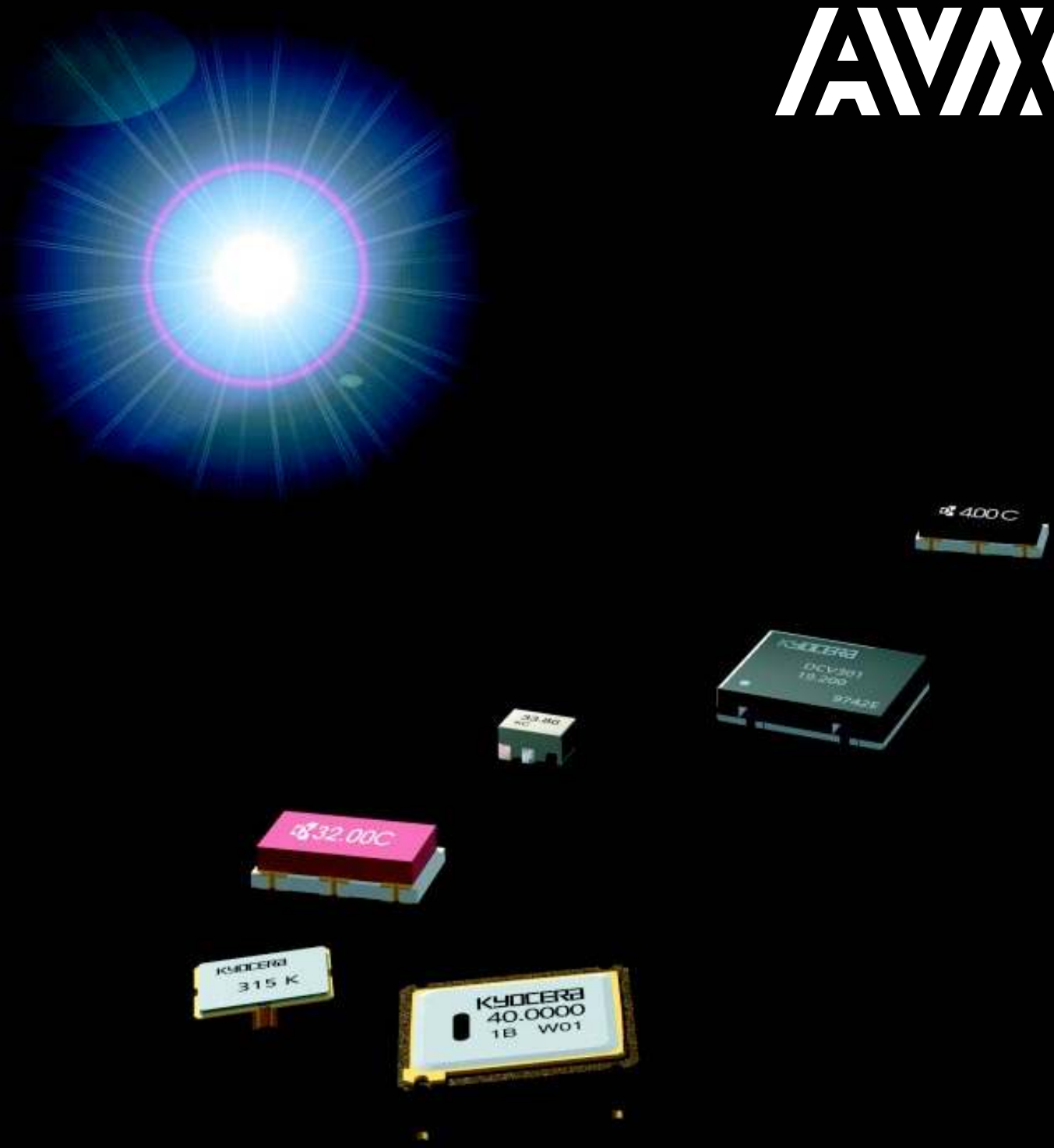

KYOCERA
Timing Devices
Resonators Crystals Oscillators

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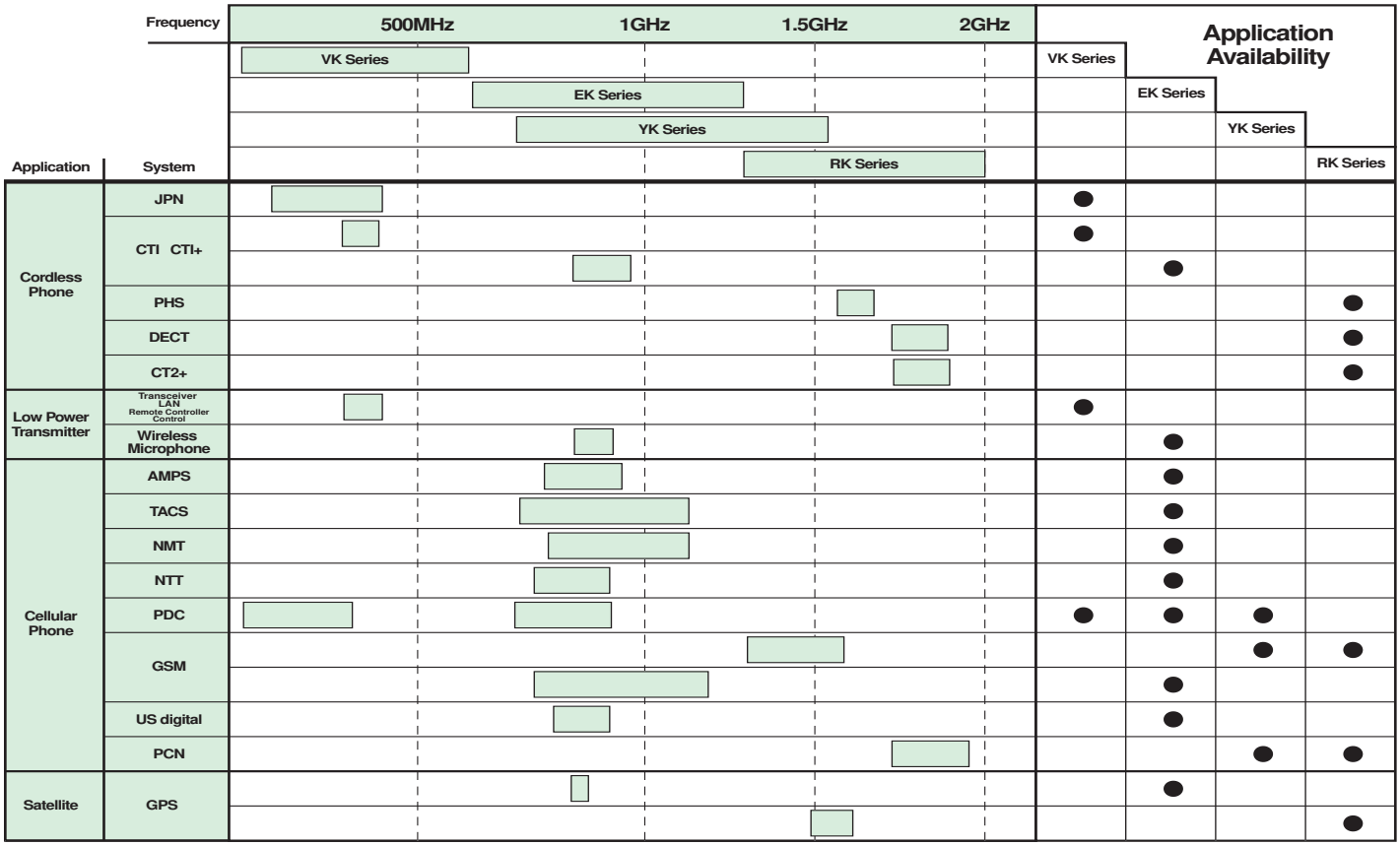
Timing Device Product Offering

QUARTZ CRYSTALS, RESONATORS and CLOCK OSCILLATORS

Product Name		Type	Oscillating Frequency (1KHz 10KHz 100KHz 1MHz 10MHz 100MHz 1GHz 10GHz)	Applications
Quartz Crystal		Leaded	12.0M ~ 22.0M	Telecommunication
		SMD	12.0M ~ 22.0M	Telecommunication
Ceramic Resonator	KHz Band	Leaded	190k ~ 680k, 795k ~ 815k, 960k ~ 1050k	Micro Processor
		SMD	380k ~ 430k, 440k ~ 525k, 600k ~ 655k, 795k ~ 815k, 960k ~ 1050k	Micro Processor
	MHz Band	Leaded	1.92M ~ 40.0M	Micro Processor
		SMD	2.0M ~ 60.0M	Micro Processor
Saw Resonator		Leaded	46M ~ 479M	RF Modulator Keyless Entry
		SMD	300M ~ 479M	RF Modulator Keyless Entry
Clock Oscillator		Leaded	500k ~ 72M	Micro Processor
		SMD	8.0M ~ 68M	Micro Processor
	KT 11,12,14 Series	SMD	12.0M ~ 20.0M	Telecommunication

VOLTAGE CONTROLLED OSCILLATORS



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kHz BAND CERAMIC RESONATORS

Part Series	Frequency Range	Type	Lead Configuration
KBR-Y	380 to 1050 kHz	SMT	Gull Wing Surface Mount
KBR-B	190 to 680 kHz	Std Q_m	Standard, Single-in-line, Formed Leads
KBR-BK	380 to 655 kHz	Std Q_m	Standard, Single-in-line
KBR-F	795 to 1050 kHz	High Q_m	Standard, Single-in-line
Specials	Per application	—	—

MHz BAND CERAMIC RESONATORS

Part Series	Frequency Range*	Type
PBRC-A	2.00 to 8.00 MHz	SMT without Capacitor
PBRC-B/D	2.00 to 36.00 MHz	SMT with Built-in Capacitor
SSR-B	16.00 to 60.00 MHz	Ultraminiature SMT with Built-in Capacitor
KBR-MS	2.00 to 3.57 MHz	Standard
KBR-MSA	3.58 to 8.00 MHz	Water resistant
KBR-MSB	3.58 to 6.00 MHz	“No-Clean” Process only
KBR-M	6.01 to 13.00 MHz	Standard
KBR-MY	13.01 to 16.00 MHz	CMOS
KBR-MSA	16.00 to 36.00 MHz	High Frequency Standard
KBR-MKS	3.58 to 8.00 MHz	Built-in Capacitor –Low Profile
KBR-MKC	3.58 to 8.00 MHz	Built-in Capacitor -“No-Clean” Process only
KBR-MKD	3.58 to 8.00 MHz, 16.00 to 36 MHz	Built-in Capacitor-Water resistant

*For additional frequencies consult factory.

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GENERAL DESCRIPTION

AVX/Kyocera produces a broad range of high quality ceramic resonators covering both the kilohertz and megahertz frequency ranges. The high quality and extensive coverage of this product line allows optimum design of almost any oscillating circuit.

Ceramic resonators stand between quartz crystal oscillators and LC/RC oscillators in regard to accuracy but are considerably smaller, require no adjustments, have improved start-up times, and are low in cost.

Their oscillation is dependent upon mechanical resonance associated with their piezoelectric crystalline structure. These materials (usually barium titanate or lead-zirconium titanate, PZT) have large dipole movement which causes the distortion or growth of the crystal by an applied electric field. The resonance frequency depends on the vibration mode as shown in Figure 1.

A basic feedback circuit is shown in Figure 2. It consists of an amplifier with a 180° phase shift and attenuator. A negative polar output (volt) is obtained with an amplitude equal to the gain of the amplifier times the input voltage ($G \times V_{IN}$). After the signal goes through the feedback network with an attenuation ratio of ß, a negative polar wave equal to $ß \times (G \times V_{IN})$ is fed back to the input. If this feedback is greater than the initial input voltage (V_{IN}), oscillation will occur. This satisfies the two conditions necessary for oscillation:

1. $G \times ß > 1$
2. Phase cycle around the loop is an integral multiple of 360°.

Table I
Oscillators and Resonator Frequency Application

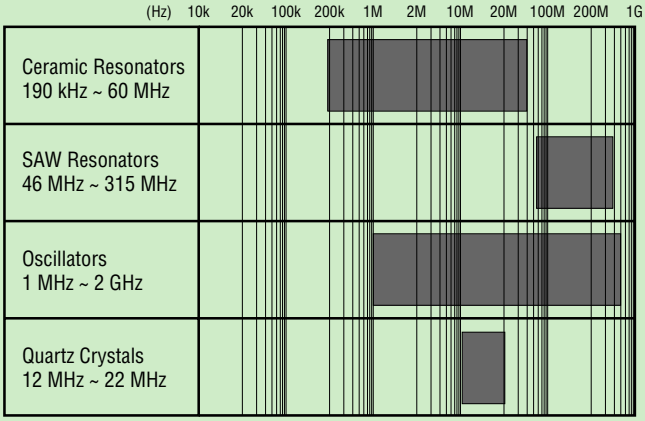


Table II
Timing Devices

Type	Symbol	Frequency Tolerance	Typical Frequency Stability	Relative Size	Cost
LC		±2%	±500ppm/°C	Largest	Low
RC		±1%	±100ppm/°C	Smallest	Low
Ceramic Resonator		±0.5%	±50ppm/°C	Next to Smallest	Low
Quartz Crystal		±0.002%	±1ppm/°C	Next to Largest	High

Figure 1: Vibration Modes vs Frequency

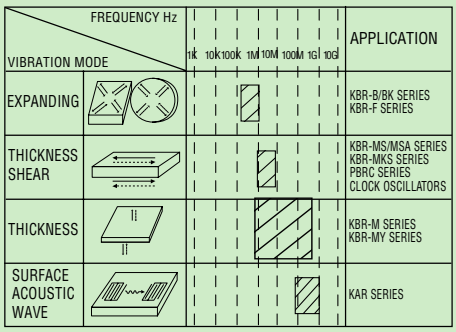


Figure 2: Basic Feedback Circuit

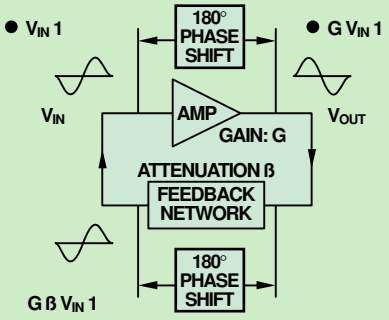
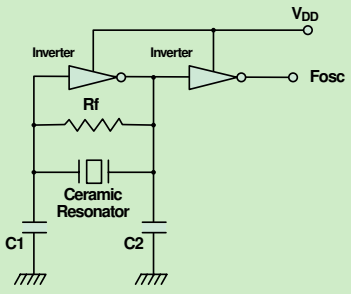


Figure 3: Oscillator Circuit



EXAMPLE

Inverter:	MC14069UBP
Vcc:	5 V.D.C.
Rf:	1M ohms
C1, C2:	100 pF (455 kHz Resonator)
	33 pF (4.00 MHz Resonator)

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GENERAL DESCRIPTION continued

The mechanical vibration of a ceramic resonator can be represented by an equivalent electrical circuit consisting of L, C, and R's (Figure 4). The impedance and phase curves of a ceramic resonator are shown in Figure 5.

Between the resonant frequency (f_r) and the anti-resonant frequency (f_a), the ceramic resonator acts like an inductor with performance identical to a coil and a resistor (Figure 4-B). At other frequencies, it has capacitive characteristics (Figure 4-A).

The equivalent circuit parameters can be determined from the resonant and anti-resonant frequencies. These equations are shown in Table III with the equivalent circuit parameters of typical AVX/Kyocera resonators shown in Table IV.

Ceramic resonators have much lower Q_m and higher equivalent capacitances than crystal oscillators. Oscillation circuits of various I.C.'s can be either low (inverter) or high (Schmidt) gain.

Figure 4:
Electrical Equivalent Circuit

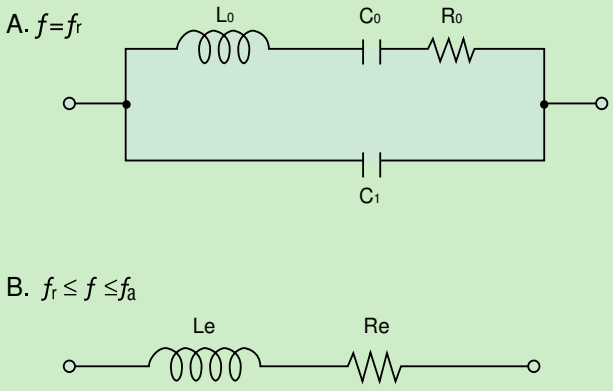

Figure 5:
Impedance and Phase Charts

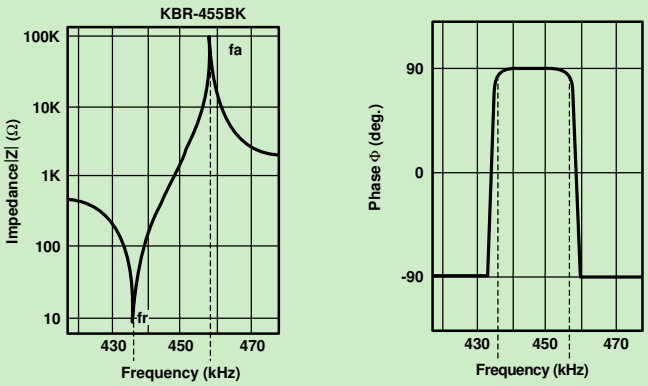

Table III: Equivalent Circuit Equations

$$f_r = \frac{1}{2\pi\sqrt{L_0 C_0}}$$

$$f_a = \frac{1}{2\pi\sqrt{L_0 C_0 C_1/(C_0+C_1)}}$$

$$f_a = f_r\sqrt{1+\left(\frac{C_0}{C_1}\right)}$$

$$Q_m = \frac{1}{2\pi f_r R_0 C_0}$$

$$L_0 = \frac{1}{4\pi^2 f_r^2 C\left[1-\left(\frac{f_r}{f_a}\right)^2\right]}$$

$$C_0 = C\left[1-\left(\frac{f_r}{f_a}\right)^2\right]$$

where $C = C_0 + C_1$

$$Q_m = \frac{1}{2\pi f_r R_0 C\left[1-\left(\frac{f_r}{f_a}\right)^2\right]}$$

Table IV: Typical Parameters of the Equivalent Circuit

	KBR-4.00MSA/MSB	KBR-455(BK)
R_0	8Ω	6Ω
L_0	318µH	3.2mH
C_0	5.4pF	43pF
C_1	42pF	360pF
Q_M	970	1600

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APPLICATION AND TEST CIRCUITS

In some circuits, a feedback resistor (R_f, Figure 1) is required to allow oscillation to start when the power is initially applied. Its value is generally 1 MΩ in ceramic resonator circuits.

Special attention should be paid to the design of oscillator circuits, because they have a significant impact on the performance of the system. To determine proper circuit parameters, careful consideration must be given to each component's characteristics under normal and marginal working conditions. Recommended component values for various IC's and microprocessors are given in theAppendix "Application Circuits for Ceramic Resonators." These values should be checked in the actual operating circuit to confirm their performance over changing conditions of input voltage and temperature.

Figure 1:
CMOS Clock Generator 480kHz

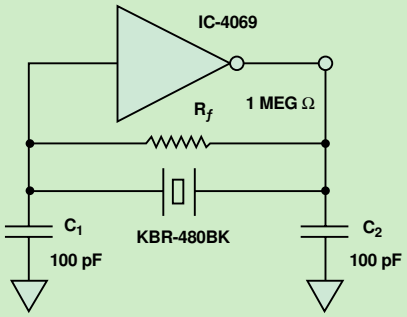
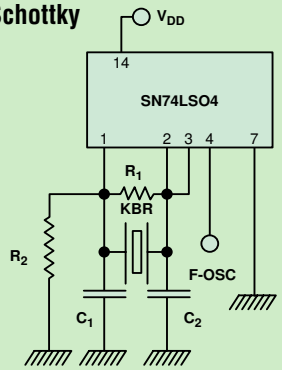


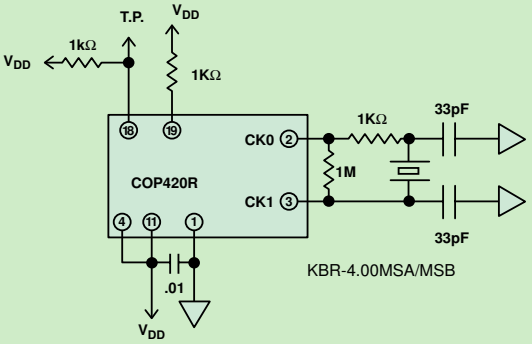
Figure 2:
Low Power Schottky



KBR-4.00MSA/MSB
KBR-6.00MSA/MSB
KBR-8.00M

R_1: 4.7 k ohm
R_2: 2.2 k ohm
C_1,C2: 220 pF
C_1,C2: 120 pF
C_1,C2: 82 pF

Figure 3:
4 Bit Microprocessor Clock



KBR-4.00MSA/MSB

Figure 4:
Test Circuit Spurious Response

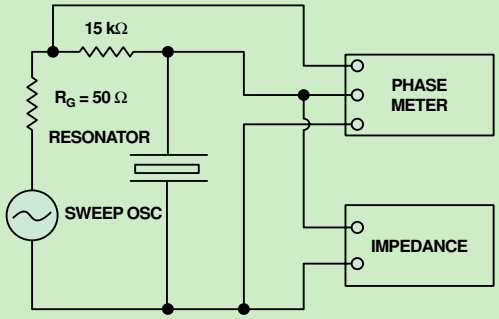
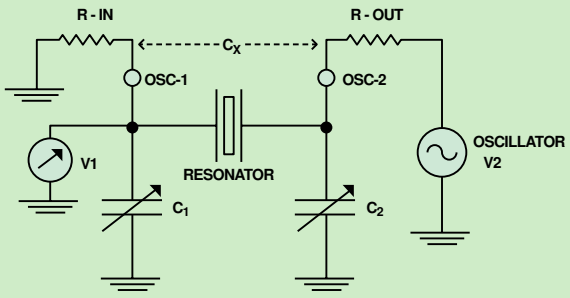


Figure 5:
Simulation Circuit

$$ß = 20 \text{ LOG } \frac{V1}{V2} \text{ (DB)}$$

$$Ø = Ø_{V2} - Ø_{V1}$$



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APPLICATION AND TEST CIRCUITS continued

The design of an oscillation circuit requires an accurate choice of circuit components to ensure oscillation within the specific voltage range of the IC (Figure 6). Semiconductor manufacturers' data books categorize V_H and V_L for both input and output requirements. The next stage of a design can be driven from either the IC input or output. Special attention should be paid to V_{IH} and V_{IL} or V_{OH} and V_{OL} depending upon where the next stage comes from the IC.

Oscillation frequency and amplitude depend upon the values of the external load capacitors (C_1, C_2). These effects are illustrated in Figures 7, 8 and 9. When the feedback ratio and the input oscillation amplitude are decreased too far, the circuit becomes vulnerable to external noise and might oscillate spuriously with the external noise.

There are some cases when a high gain IC or one with a wide non-linear range will give abnormal oscillation from sub-vibration of the resonator. This can be prevented by adding a damping resistor to decrease the feedback ratio or by increasing the load capacitance values. The spurious characteristics of typical AVX/Kyocera kHz and MHz resonators are shown in Figures 10 and 11.

Figure 6:
Oscillation Level

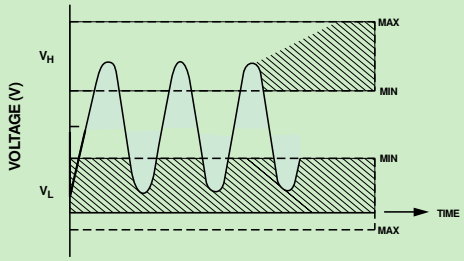


Figure 7:
Load Capacitor Effects

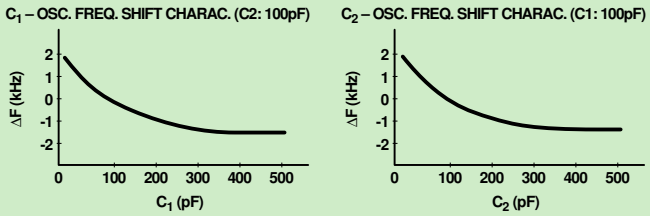


Figure 8:
C_2 Held Constant OSC Voltage Characteristics

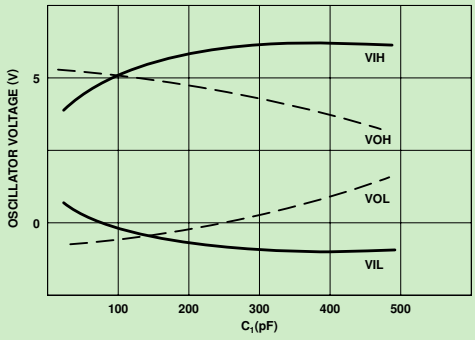


Figure 9:
C_1 Held Constant OSC Voltage Characteristics

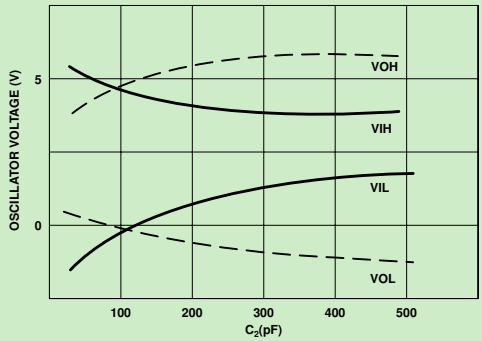


Figure 10:
kHz Spurious Response

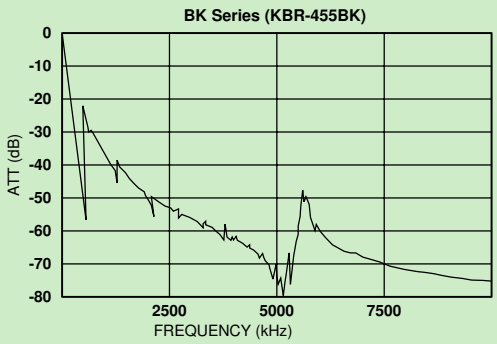
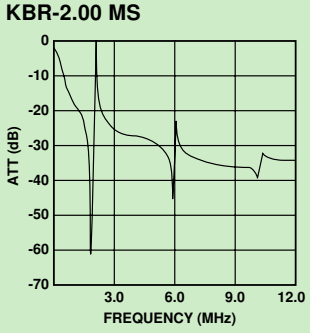
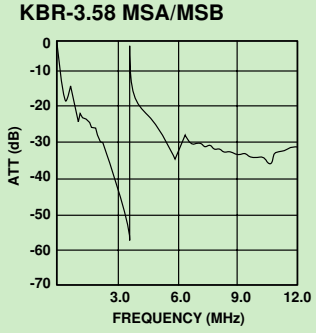


Figure 11:
MHz Spurious Response

MS SERIES
KBR-2.00 MS



MSA/MSB SERIES
KBR-3.58 MSA/MSB



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KBR -Y Series Surface Mountable Ceramic Resonators

kHz Band SMT Formed Leads Ceramic Resonators f_o: 380 to 1050 kHz

FEATURES

1) Reflow solderable
2) Washable
3) Surface mountable
4) 1000 pcs. per reel
5) Sold in increments of 2000 pcs.

HOW TO ORDER

KBR - 455 Y TR

① ② ③ ④

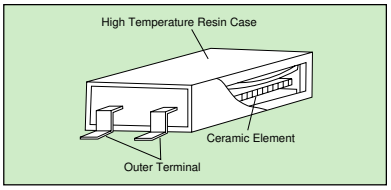
①Type: (Kyocera Bulk Resonator)

②Oscillation frequency:
380 to 1050 kHz

③Resonator type:
Y = Surface mountable

④Packaging:
TR = Tape and reel

STRUCTURE

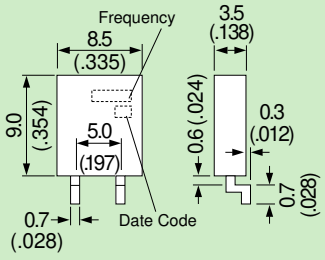


SPECIFICATIONS (KBR-□ Y)

Parameters	Fig. A	Fig. B		Fig. C	
Frequency Range	380 to 430 kHz	440 to 525 kHz	600 to 655 kHz	795 to 815 kHz	960 to 1020 kHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
Resonant Impedance	20 Max	20 Max	50 Max	70 Max	100 Max
Anti-resonant Impedance	30k Min	35k Min	50k Min	70k Min	70k Min
Temperature Characteristics (-20 to +80°C)	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%
C_1	100pF	100pF	100pF	100pF	100pF
C_2	470pF	100pF	100pF	100pF	100pF
Standard Oscillation Frequency	400kHz	455kHz 480kHz 500kHz	600kHz 640kHz	800kHz	1000kHz

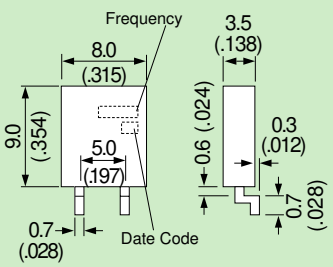
DIMENSIONS

Fig. A



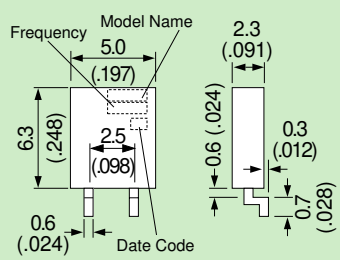
unit: mm (inch)

Fig. B



unit: mm (inch)

Fig. C



unit: mm (inch)

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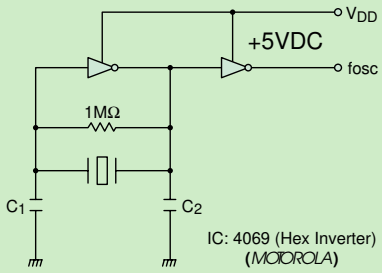
KBR -Y Series Surface Mountable Ceramic Resonators

kHz Band SMT Formed Leads Ceramic Resonators f_o: 380 to 1050 kHz

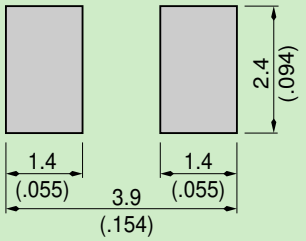
TEST CIRCUIT



SUGGESTED LAND PATTERNS

380 to 430 kHz
440 to 525 kHz
600 to 655 kHz

795 to 815 kHz
960 to 1050 kHz



unit: mm (inch)

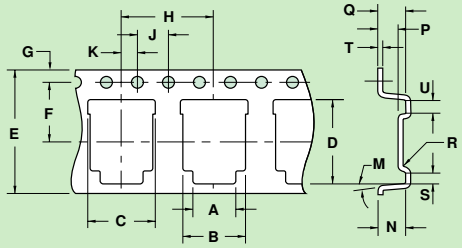
PACKAGING (KBR-□Y TYPE)

TAPE DIMENSIONS – 380 TO 430 / 440 TO 525 / 600 TO 655 kHz

A ±0.2	B ±0.2	C ±0.2	D ±0.2	E ±0.3	F ±0.2	G ±0.1	H ±0.1	J ±0.1	K ±0.1	L ±0.1	M	N ±0.2	P ±0.2	Q ±0.2	R	S ±0.2	T ±0.1	U ±0.2
6.7	8.5	8.7	11.25	16.0	7.5	1.75	12.0	4.0	2.0	1.5	10max	4.8	4.1	4.3	.3max	1.7	0.4	1.9

TAPE DIMENSIONS – 795 TO 815 / 960 TO 1050 kHz

A ±0.2	B ±0.2	C ±0.2	D ±0.2	E ±0.3	F ±0.2	G ±0.1	H ±0.1	J ±0.1	K ±0.1	L ±0.1	M	N ±0.2	P ±0.2	Q ±0.2	R	S ±0.2	T ±0.1	U ±0.2
3.9	5.5	5.7	8.55	16.0	7.5	1.75	8.0	4.0	2.0	1.5	10max	3.6	2.9	3.1	.3max	1.7	0.4	1.9



Note: Quantity per reel equals 1000 pieces.

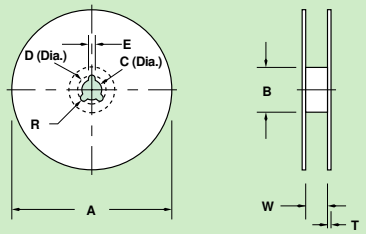
unit: mm

REEL DIMENSIONS – 380 TO 430 / 440 TO 525 / 600 TO 655 kHz

A ±1.5	B ±1.0	C ±0.5	D ±0.5	E ±0.5	R	W ±2.5	T
330	80	13	21	2.0	1.0R	17.5	3.0max

REEL DIMENSIONS – 795 TO 815 / 960 TO 1050 kHz

A ±1.5	B ±1.0	C ±0.5	D ±0.5	E ±0.5	R	W ±2.5	T
250	80	13	21	2.0	1.0R	17.5	2.5max



unit: mm

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KBR -B, -BK, -F Series Ceramic Resonators

kHz Band Ceramic Resonators

f_o: 190 to 1050 kHz

FEATURES

1) Optimum selection of oscillation parameters possible according to application
2) Highly reliable design with excellent environmental resistance
3) Standard frequency range of 190 kHz to 1050 kHz
4) Formed lead type also standardized for use in low profile devices
5) Packaged in bags of 500 pcs.
6) Sold in increments of 2000 pcs.

HOW TO ORDER

KBR - 455 BK TS

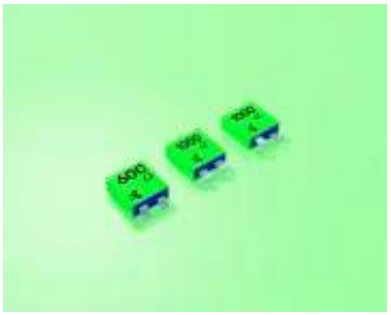
① ② ③ ④

① Type: (Kyocera Bulk Resonator)

② Oscillation frequency:
190 to 1050 kHz

③ Resonator types:
B/BK = 190 to 680 kHz
F = 795 to 1050 kHz

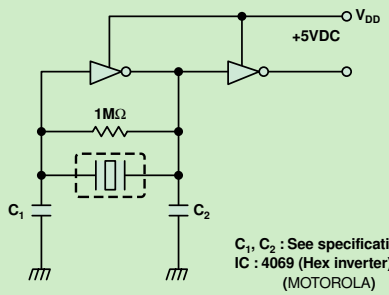
④ Lead style:
□ = Standard
TS = Single-in-line
TL = Formed lead



SPECIFICATIONS (KBR-□B/KBR-□BK/KBR-□F)

Configuration	Fig. A	Fig. B	Fig. C	Fig. D	Fig. E			Fig. F		Fig. G	
Type	B	B	BK	B	BK	BK	BK	B	B	F	F
Frequency Range	190 to 249 kHz	250 to 379 kHz	380 to 430 kHz	431 to 439 kHz	440 to 525 kHz	540 to 599 kHz	600 to 655 kHz	526 to 539 kHz	656 to 680 kHz	795 to 815 kHz	960 to 1050 kHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
Resonant Impedance	20 Max	20 Max	20 Max	20 Max	20 Max	20 Max	50 Max	20 Max	50 Max	70 Max	100 Max
Antiresonant Impedance	25k Min	30k Min	30k Min	30k Min	35k Min	35k Min	50k Min	35k Min	50k Min	70k Min	70k Min
C_1	330pF	220pF	100pF	100pF	100pF	100pF	100pF	100pF	100pF	100pF	100pF
C_2	470pF	470pF	470pF	470pF	100pF	100pF	100pF	100pF	100pF	100pF	100pF
Temperature Characteristics (-20 to +80°C)	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%
(-40 to +85°C)	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%	+0.3% -0.5%
Standard Oscillation Frequency	200kHz	300kHz	400kHz	—	455, 480, 500kHz	540, 560kHz	600, 640kHz	—	680kHz	800kHz	1000kHz
Case Color	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Green	Green

TEST CIRCUIT



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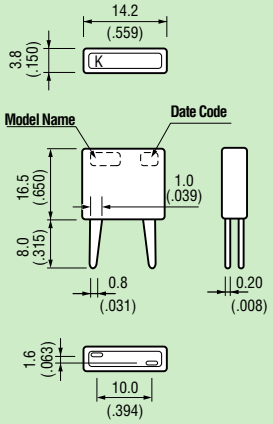
KBR -B, -BK, -F Series Ceramic Resonators

kHz Band Ceramic Resonators

f_o: 190 to 1050 kHz

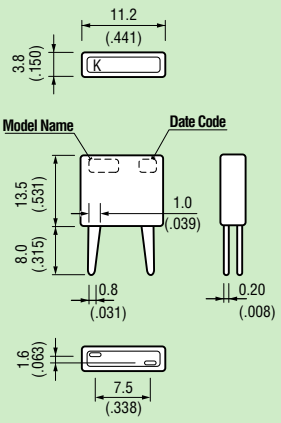
DIMENSIONS

Fig. A
190 to 249 kHz (B-Type)



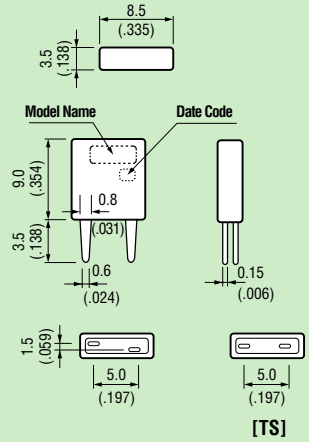
unit: mm (inch)

Fig. B
250 to 379 kHz (B-Type)



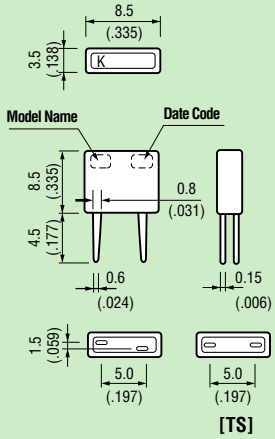
unit: mm (inch)

Fig. C
380 to 430 kHz (BK-Type)



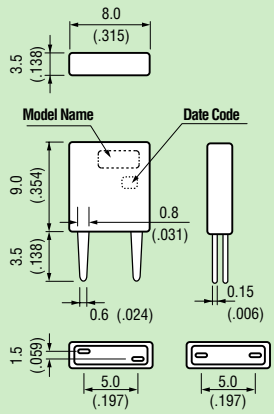
unit: mm (inch)

Fig. D
431 to 439 kHz (B-Type)



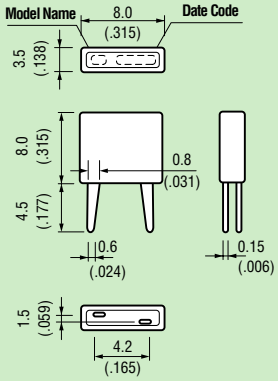
unit: mm (inch)

Fig. E
440 to 525/540 to 655 kHz
(Types: BK, AK, HK, AHK)



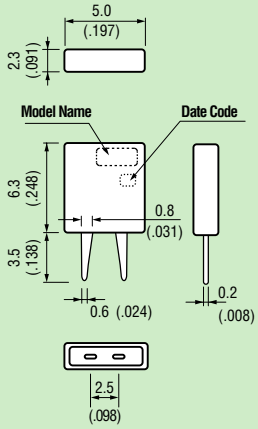
unit: mm (inch)

Fig. F
526 to 539/656 to 680 kHz (B-Type)



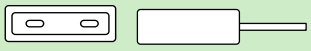
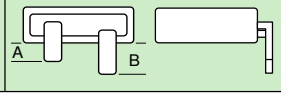
unit: mm (inch)

Fig. G
795 to 815/960 to 1050 kHz (F-Type)



unit: mm (inch)

LEAD FORMATIONS

Lead Type	Lead Shape	Frequency Range								
		B–Type			BK–Type			F–Type		
TS		—			380 to 430 kHz 440 to 525 kHz 540 to 655 kHz			795 to 815 kHz 960 to 1050 kHz **Single in-line is standard for F series**		
TL			A*	B*		A*	B*		A*	B*
		250 to 379 kHz	3.0	3.0	380 to 430 kHz	3.5	5.0	795 to 815 kHz	1.9	1.9
		431 to 439 kHz	4.5	6.0	440 to 525 kHz	3.5	5.0	960 to 1050 kHz	1.9	1.9
		526 to 539 kHz	4.5	6.0	540 to 655 kHz	3.5	5.0			
		656 to 680 kHz	4.5	6.0						

*Dimensions in mm.

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KBR Special Series Ceramic Resonators

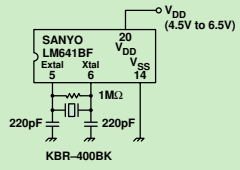
kHz Band Ceramic Resonators

SPECIAL RESONATORS

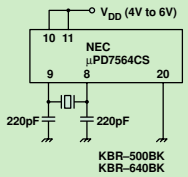
Application	Model No.	Oscillation Frequency	Variable Frequency Range	Resonant Impedance	Anti-resonant Impedance	Temperature Characteristics	Dimensions (page 11)	IC
Horizontal synchronous oscillator control circuit of TV set	KBR-503.5AKTS1	504.5±2.0kHz	±15kHz min.	30 max.	—	±0.5% max. (-20°C~+80°C)	Fig. E	LA7620 (SANYO)
	KBR-503.5AKTS12	504.5±2.0kHz	±12.8kHz min.					LA7650(SANYO)
	KBR-503.5AKTS16	501.7±2.0kHz						LA7680(SANYO)
	KBR-503.5AKTS2	503.5±2.0kHz						µPC1400C(NEC)
	KBR-503.5AKTS3	503.5±2.0kHz	±15kHz min					µPC1401CA (NEC)
	KBR-503.5AKTS4	525.6±2.0kHz *1(fr)	52±10kHz *2(f)					M51307SP (MITSUBISHI)
	KBR-503.5AKTS5	516.4±2.0kHz*1(fr)	51±10kHz *2(f)					
	KBR-500AKTS1	500.0±2.0kHz	±16kHz min.					µPC1403CA (NEC)
Horizontal synchronous detection circuit of VCR	KBR-500AHKTS2	500.0±1.5kHz	—	20 max.	70k min.	±0.6% max. (-20°C~+80°C)	Fig. E	LA2710LA7212
	KBR-503.5AHKTS2	503.5±1.5kHz						LA7215 (SANYO)
FM stereo MPX	KBR-457HKTS	18.950kHz±38Hz	17.0kHz min. *2(f)	20 max.	70k min.	±0.2% max. (-15°C~+75°C)	Fig. E	LA3400N,LA3401 LA3410,LA3430 (SANYO)
	KBR-457HKTS1							LA3400 (SANYO)
	KBR-912F102	912kHz±0.3%	38kHz min. *2(f)	100 max.	30k min.	—	Fig. G	TA2080F (TOSHIBA)
	KBR-912F103							TA2046FN (TOSHIBA)
	KBR-912F104							LA1867M(SANYO)
	KBR-912F108							LA1780M(SANYO)
Detection of search stop signal of electronic tuner	KBR-450AHKTS5	450.0±0.5kHz *1(fr)	9.0±2.0kHz *2(f)	30 max.	—	±0.5% max. (-20°C ~ +60°C)	Fig. E	—
	KBR-450AHKTS8	450.0±0.8kHz *1(fr)				±0.8% max. (-20°C ~ +60°C)		
	KBR-450AHKTS1	450.0±1.0kHz *1(fr)						
	KBR-459AHKTS5	459.0±0.5kHz *1(fr)				±0.5% max. (-20°C ~ +60°C)		
	KBR-459AHKTS8	459.0±0.8kHz *1(fr)				±0.8% max. (-20°C ~ +60°C)		
	KBR-459AHKTS1	459.0±1.0kHz *1(fr)						
RF modulator for PAL system	KBR-500AHKTS15	500.0±1.5kHz	—	20 max.	70k min.	±0.3% max. (-20°C ~ +80°C)	Fig. E	BA7004 (Rohm)
	KBR-500AHKTS3	500.0±1.5kHz						LA7053 (SANYO)
FDD motor control circuit	KBR-491.5BK0L2	491.5kHz±0.3%	—	20 max.	35 min.	±0.3% max. (-20°C ~ +80°C)	—	HA13440MP(HITACHI)
	KBR-983F0L1	983kHZ±0.3%		100 max.	70k min.			HA13468MP(HITACHI)
	KBR-610.2BK0L4	610.2kHz±0.3%		50 max.	50k min.			M51785(MITSUBISHI)
	KBR-460.8BK4	460.8kHz±0.3%		20 max.	35k min.			BA6472 (Rohm)
Telephone unit	KBR-480BKTS3	480kHz±0.3%	—	20 max.	35k min.	±0.3% max. (-20°C~ +80°C)	Fig. E	TC31018P(TOSHIBA)
	KBR-480BKTS-TM1	480kHz±0.3%						TMP47C26N(TOSHIBA)
	KBR-960F3	960kHz±0.3%		100 max.	70k min.		Fig. G	TMP47C456AF(TOSHIBA)

*1: f_r=resonant frequency, *2: f=f_a-f_r (f_a=anti-resonant frequency), *3: When used in conjunction with special stereo MPX IC's.

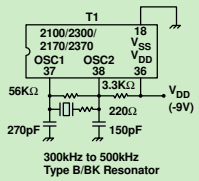
APPLICATION CIRCUITS



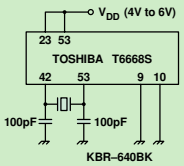
MICROCOMPUTER



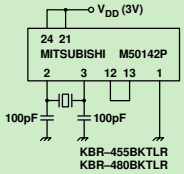
MICROCOMPUTER



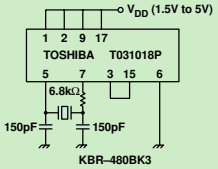
MICROCOMPUTER



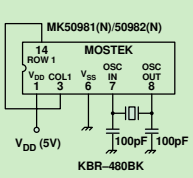
AUDIO REC/PLAY



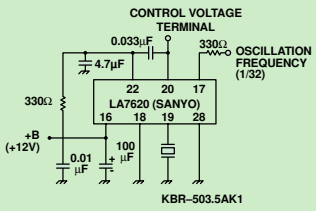
REMOTE CONTROL TRANSMITTER



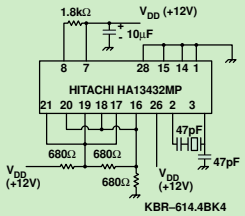
TONE DIALER



PULSE DIALER



TV HORIZ SYNC



FDD MOTOR

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PBRC -A Series Chip Resonators

MHz Band SMT Resonators

f_o: 2.00 to 8.00 MHz

FEATURES

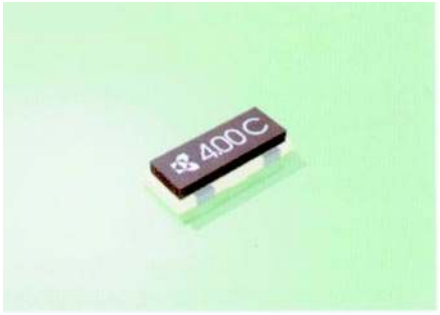
1) High reliability chip resonator in a ceramic case which can be reflow soldered and washed
2) Ultra-miniature size is suitable for compact equipment and high mounting density
3) Rectangular shape allows easy "pick and place" operation
4) 2000 pcs. per reel
5) Sold in increments of 2000 pcs.

HOW TO ORDER

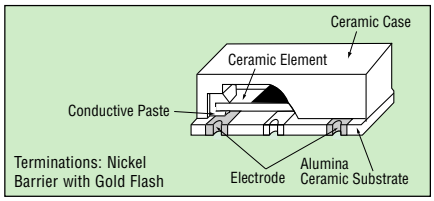
PBRC - 4.00 A R

① ② ③ ④

① Type: (Piezo Bulk Resonator Chip)
② Oscillation frequency (MHz)
③ Resonator type:
A = Without capacitor
④ Packaging:
R = Tape and reel



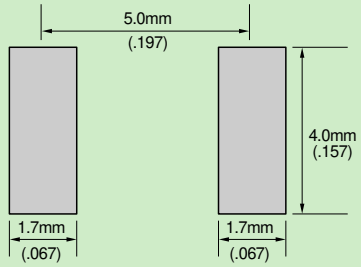
STRUCTURE



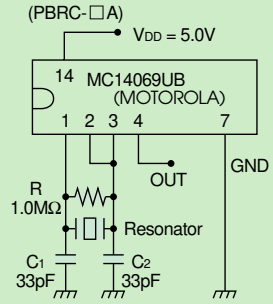
SPECIFICATIONS (PBRC-□A)

Frequency Range	2.00 to 8.00 MHz
Frequency Tolerance	±0.5%
Resonant Impedance	200Ω Max at 2.00~2.90MHz 100Ω Max at 3.00~3.57MHz 30Ω Max at 3.58~8.00MHz
Temperature Characteristics (-20 to +80°C)	±0.3%

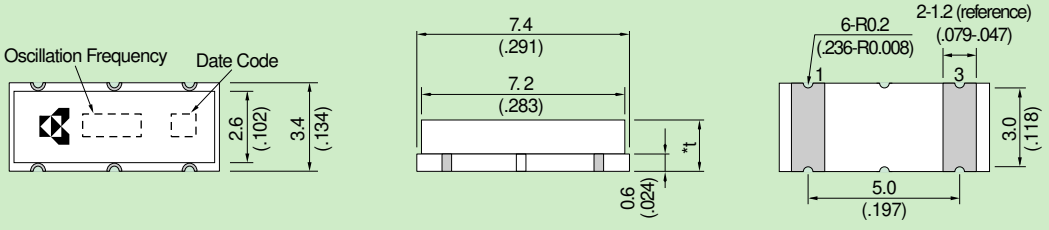
RECOMMENDED LAND PATTERN FOR PBRC-□A



STANDARD TEST CIRCUIT



DIMENSIONS



1, 3: Input, Output (no polarity)
•t=PBRC A Series: 2.0 max.
Tolerances = ±0.3mm

Unit: mm (inch)

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PBRC -B, -D Series Chip Resonators

Built-in Capacitor MHz Band SMT Resonators

f_o: 2.00 to 36.00 MHz

FEATURES

1) Built-in load capacitor
2) High reliability chip resonator in a ceramic case which can be reflow soldered and washed
3) Ultra-miniature size is suitable for compact equipment and high mounting density
4) Rectangular shape allows easy “pick and place” operation
5) 2000 pcs. per reel
6) Sold in increments of 2000 pcs.

HOW TO ORDER

PBRC - 4.00 B R _

① ② ③ ④ ⑤

① Type: (Piezo Bulk Resonator Chip)

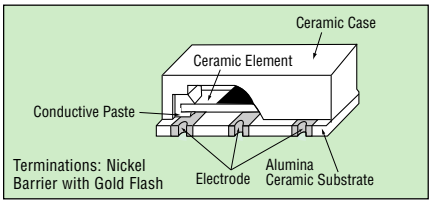
② Oscillation frequency (MHz)

③ Resonator type:
B = With capacitor (2.00~20.00MHz)
D = With capacitor (20.01~36.00MHz)

④ Packaging:
R = Tape and reel

⑤ Frequency tolerance:
☐ = ±0.5% (2.00~8.00MHz)
07 = ±0.7% (8.01~20.00MHz)
☐ = ±0.5% (20.01~36.00MHz)

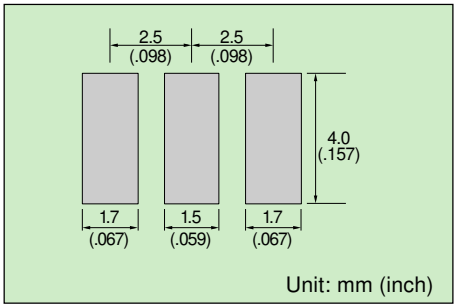
STRUCTURE



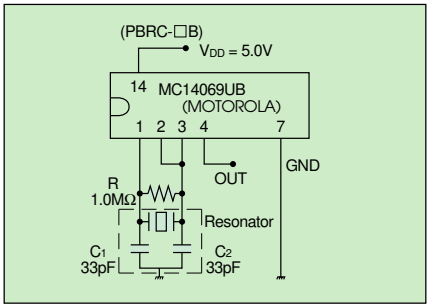
SPECIFICATIONS (PBRC-☐B/PBRC-☐D)

Series Type	B		D
Frequency Range	2.00 to 8.00 MHz	8.01 to 20.00 MHz	20.01~36
Load Capacitor	33 pF (typ.)	10 pF (typ.)	10 pF (±10)
Frequency Tolerance	±0.5%	±0.7%	±0.5%
Resonant Impedance	2.00-2.90MHz 200Ω max.	150 Ω Max.	150 Ω Max.
	3.00-3.57MHz 100Ω max.	150 Ω Max.	150 Ω Max.
	3.58-8.00MHz 30Ω max.	150 Ω Max.	150 Ω Max.
Temperature Characteristics (-20 to +80°C)	±0.3%	±0.1%	±0.3%

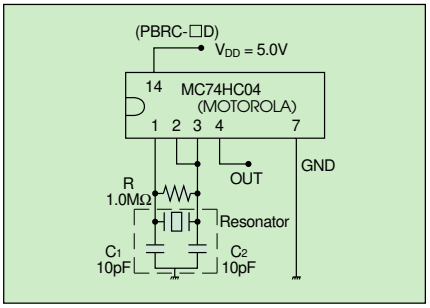
RECOMMENDED LAND PATTERN FOR PBRC-☐B/D



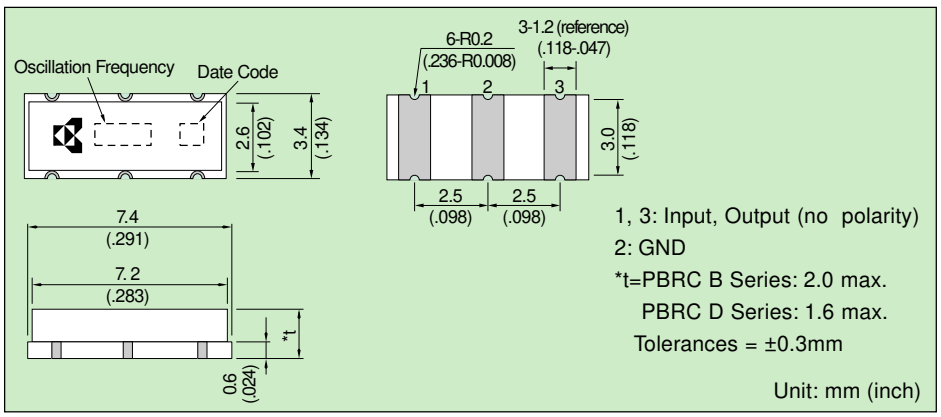
STANDARD TEST CIRCUIT 2.00 ~ 8.00 MHz



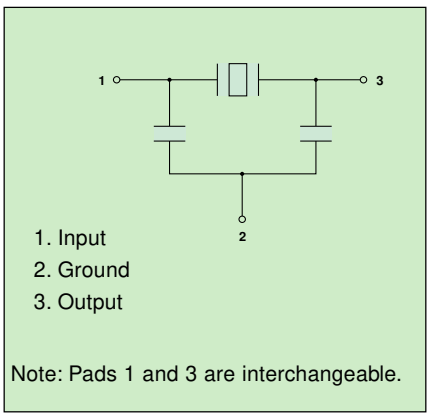
STANDARD TEST CIRCUIT 8.01 ~ 36.00 MHz



DIMENSIONS



PAD CONNECTION



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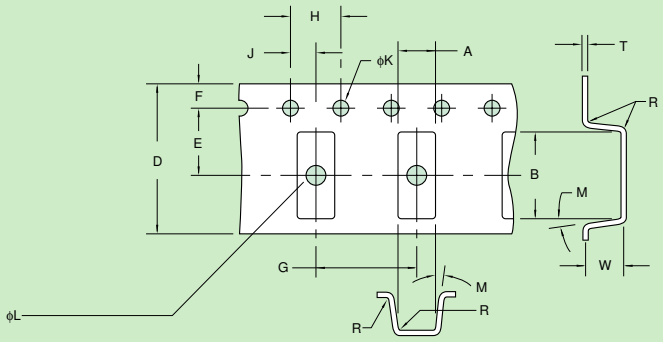
Tape & Reel Packaging

Surface Mountable Chip Resonators PBRC -A, -B, -D Types

2000 pieces per reel with 10 positions open at beginning and end of reel. Leader will be 200mm maximum.

TAPE DIMENSIONS

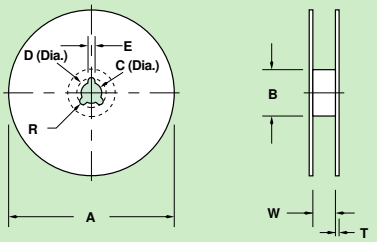
A ±0.2	B ±0.2	D ±0.3	E ±0.1	F ±0.1	G ±0.1	H ±0.1	J ±0.1	ϕK ±0.1	M	R	W ±0.2	T ±0.1	ϕL ±0.05
3.8	7.8	16.0	7.5	1.75	8.0	4.0	2.0	1.5	10°max	0.3max	2.1	0.3	1.55



Units:mm

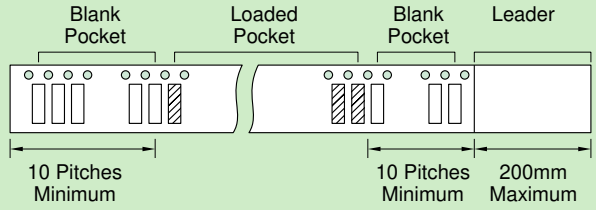
REEL DIMENSIONS

A	B	C	D	E	R	W	T
255	80	13	25	2	1.0R	17.5	2
±1.0	±0.5	±0.5	±0.8	±0.5		±1.5	±0.5

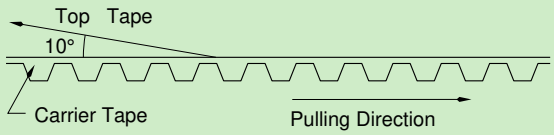


Units:mm

PACKING METHOD



TEST CONDITION OF PEELING STRENGTH



MARKING

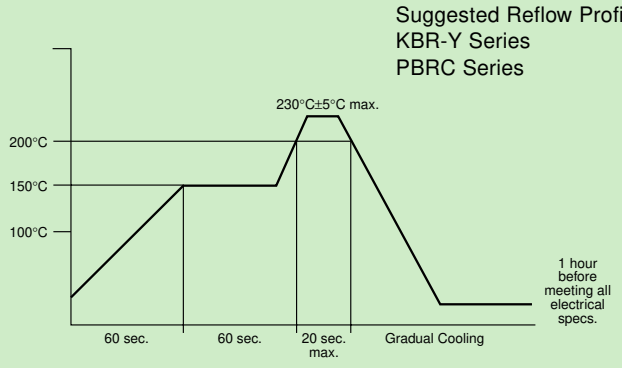
Marking of Reel

a). Type Name
b). Lot No.
c). Quantity
d). Vendor Name

Marking of Exterior Package

a). Type Name
b). Lot No.
c). Quantity of Reel
d). Shipping Date
e). Vendor Name

REFLOW PROFILE



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Capacitor Built-In Type Chip

MHz Band Ceramic Resonators - SSR-B Series

FEATURES

1) World's smallest (2.1x3.2x1.5 mm)
2) High density mounting possible
3) Wide frequency range in same case size
4) 2000 pieces per reel
5) Sold in increments of 2000 pieces

HOW TO ORDER

SSR 33.86 B R

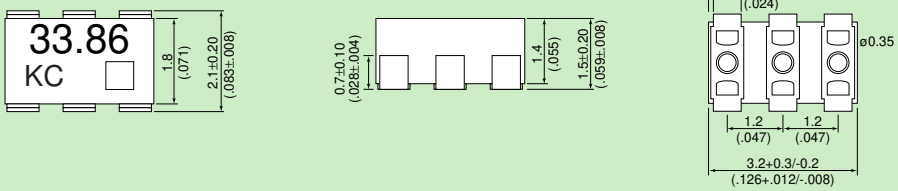
① ② ③ ④

① Type: (Super Small Resonator)
② Oscillating frequency
③ Resonator type: B = With capacitor
④ Packaging: R = Tape and reel

SPECIFICATIONS

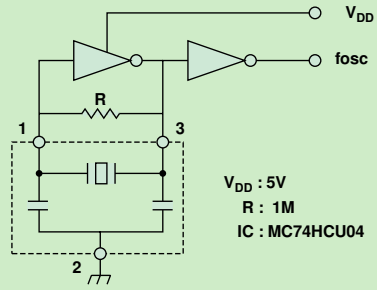
Frequency Range	Frequency Tolerance	Resonant Impedance	Temperature Stability (-20~80°C)	IC	Popular Frequencies
16~60MHz	±0.5%	100 max.	±0.3%	MC74HCU04 (MOTOROLA)	16, 25, 27, 29, 33.86, 40

DIMENSIONS

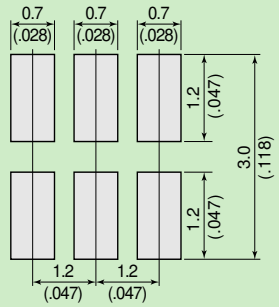


Units: mm (inches)

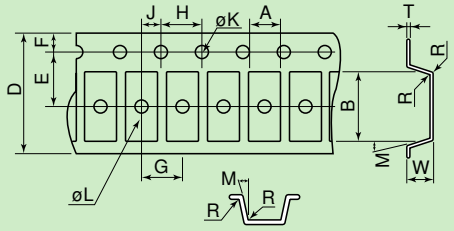
TEST CIRCUIT



RECOMMENDED LAND PATTERN



PACKAGING: TAPE and REEL



Symbol	A	B	D	E	F	G	H
Dimension	2.4	3.6	8.0	3.5	1.75	4.0	4.0
Symbol	J	K	L	M	R	W	T
Dimension	2.0	1.5	1.1	5° max.	0.3 max.	1.8	8.0

Unit: mm (inches)

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KBR -M, -MS, -MSA, -MSB Series Ceramic Resonators

MHz Band Ceramic Resonators

f_o: 2.00 to 13.00 MHz

FEATURES

1) Ultracompact, lightweight design
2) Resistant to damage from impact and vibration
3) Excellent temperature stability (±0.3%)
4) Low cost
5) Bulk packaged 500 pieces per bag or 2000 pieces per reel
6) Sold in increments of 200 pieces

HOW TO ORDER

KBR - 4.00 MSA TR

① ② ③ ④

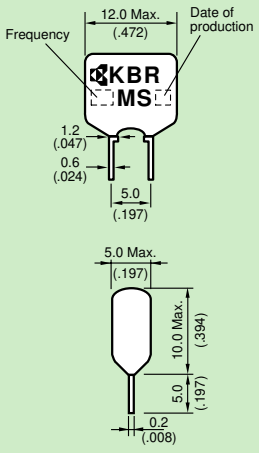
① Type: (Kyocera Bulk Resonator)
② Oscillation frequency (MHz)
③ Resonator type:
MS = 2.00 to 3.57 MHz
MSA = 3.58 to 8.00 MHz (Water resistant)
MSB = 3.58 to 6.00 MHz ("No-Clean" Process only)
M = 6.01 to 13.00 MHz
④ Packaging:
TR = Tape and reel
☐ = Bulk

SPECIFICATIONS (KBR-☐MS/KBR-☐MSA/KBR-☐MSB/KBR-☐M Series)

Series	MS	MSA, -MSB	M	M
Dimension	Fig. A	Fig. B	Fig. C	Fig. D
Oscillation Frequency	2.00 to 3.57 MHz	3.58 to 8.00 MHz	6.01 to 6.99 MHz	7.00 to 13.00 MHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%	±0.5%
Resonant Impedance	100 Max	30 Max	40 Max	40 Max
Temperature Characteristic (-20 to +80°C)	±0.3%	±0.3%	±0.5%	±0.5%

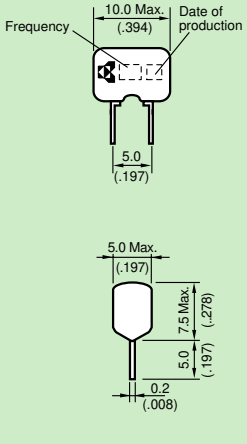
DIMENSIONS

Fig. A



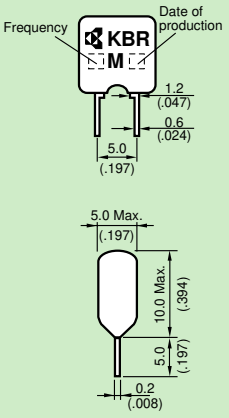
Unit: mm (inch)

Fig. B



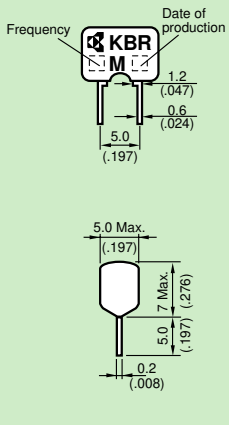
Unit: mm (inch)

Fig. C



Unit: mm (inch)

Fig. D

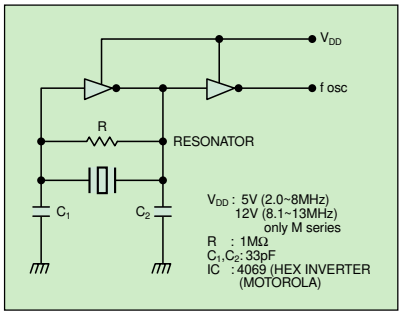


Unit: mm (inch)

KBR-3.58MSA - 200 series for Telephone D.T.M.F. Applications

P/N	Frequency	Frequency Tolerance	Resonant Resistance	Temperature Stability (-20 to +80°C)	Dimensions
KBR-3.58MSA-201	3.5795MHz	+0 -0.25%	30 Max	±0.3%	Fig. B
KBR-3.58MSA-202		+0.15 -0.10%			
KBR-3.58MSA-203		+0.30 -0.05%			
KBR-3.58MSA-204		+0.45 +0.20%			
KBR-3.58MSA-205		+0.60 +0.35%			
KBR-3.58MSA-206		-0.30 -0.55%			
KBR-3.58MSA-207		-0.15 -0.40%			

TEST CIRCUIT



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KBR -MY Series Ceramic Resonators

High Frequency MHz Band Ceramic Resonators f_o: 13.01 to 36.00 MHz

FEATURES

1) High frequency resonator to match high-speed needs
2) Faster start-up time as compared to quartz crystals
3) High durability
4) Bulk packaged 500 pieces per bag or 2000 pieces per reel
5) Sold in increments of 2000 pieces

HOW TO ORDER

KBR - 16.00 MSA TR

① ② ③ ④

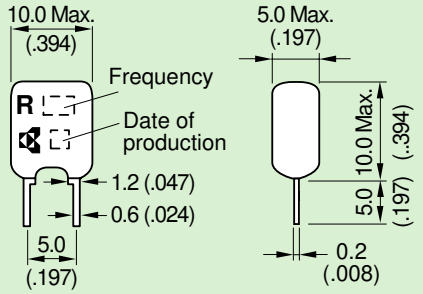
① Type: (Kyocera Bulk Resonator)
② Oscillation frequency (MHz)
③ Resonator type:
MY = CMOS IC
MSA= Standard
④ Packaging:
□ = Bulk
TR = Tape and reel

SPECIFICATIONS (KBR-□MY/KBR-□MSA)

Series Type	KBR -MY	KBR -MSA
Frequency Range	13.01 to15.99 MHz	16.00 to 36.00
Frequency Tolerance	±0.5%	±0.5%
Resonant Impedance	30 max.	30 max.
Temperature Characteristics (-20 to +80°C)	±0.3% max.	±0.3% max.

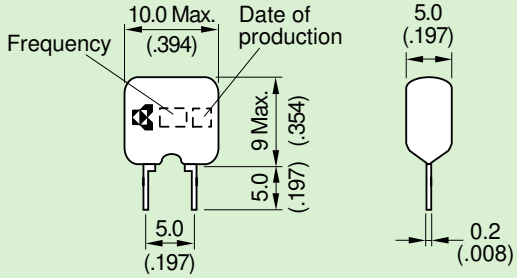
DIMENSIONS

KBR-MY Type



Unit: mm (inch)

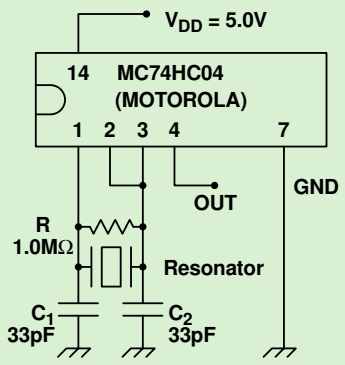
KBR-MSA Type



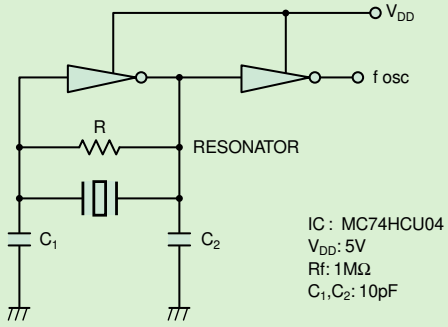
Unit: mm (inch)

STANDARD TEST CIRCUIT

KBR-MY Type



KBR-MSA Type



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KBR -MKC, -MKD, -MKS Series Ceramic Resonators

Built-in Capacitor MHz Band Ceramic Resonators f_o: 3.45 to 8.00 MHz 16.00 to 36.00 MHz

FEATURES

1) Built-in load capacitance
2) Simplified circuit
3) Reduced parts cost
4) Reduced mounting cost
5) High density mounting
5) Bulk packaged 500 pieces per bag or 2000 pieces per reel
7) Sold in increments of 2000 pieces

HOW TO ORDER

KBR - 4.00 MKC TR
① ② ③ ④

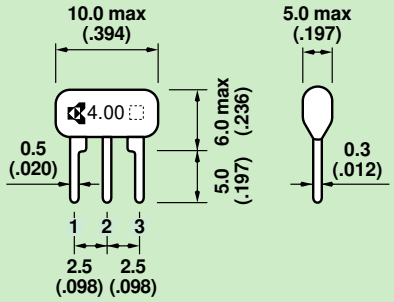
① Type: (Kyocera Bulk Resonator)
② Oscillation frequency (MHz)
③ Resonator type:
MKC = "No-Clean" Process only
MKD = Water resistant
MKS = Standard
④ Packaging:
☐ = Bulk
TR = Tape and reel

SPECIFICATIONS (KBR-☐MKC/KBR-☐MKD/KBR-☐MKS)

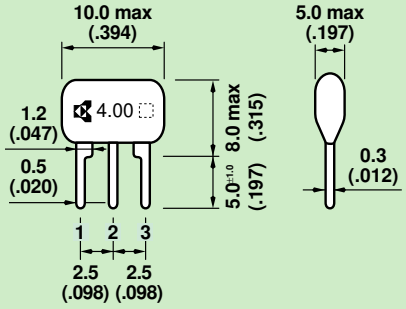
Series Type	KBR -MKC, -MKD, -MKS	KBR -MKD
Frequency Range	3.45 to 8.00 MHz	16.00 to 36.00
Frequency Tolerance	±0.5%	±0.5%
Resonant Impedance	30	30
Temperature Characteristics (-20 to +80°C)	±0.5%	±0.3%

DIMENSIONS

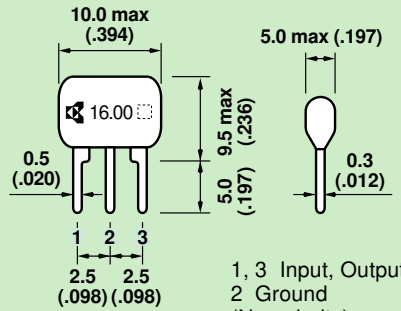
MKC, MKS TYPES



MKD TYPE (3.45 to 8.00MHz)

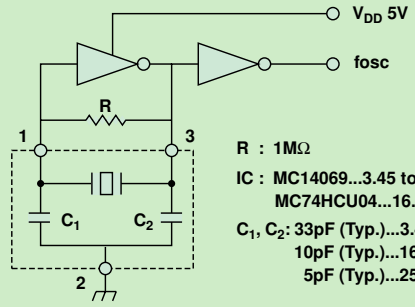


MKD TYPE (16.0 to 36.0MHz)



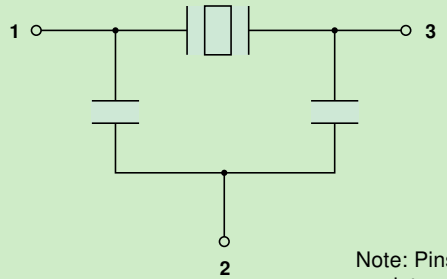
Unit: mm (inch)
Tolerance ±0.2mm unless otherwise specified

TEST CIRCUIT



R : 1MΩ
IC : MC14069...3.45 to 8.00
MC74HCU04...16.00 to 36.00
C_1, C_2: 33pF (Typ.)...3.45 to 8.00
10pF (Typ.)...16.00 to 25.00
5pF (Typ.)...25.01 to 36.00

PIN CONNECTION (No Polarity)



1. Input
2. Ground
3. Output

Note: Pins 1 and 3 are interchangeable

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Tape & Reel Packaging

MHz Ceramic Resonators

TAPE AND REEL PACKAGING

- 2000 pieces per reel
- Min. of 3 open positions at the beginning and end of tape

AMMO PACK

- 2000 pieces per package
- A minimum of 38.1mm or three positions shall be open at beginning and end of tape
- Each fold shall be 317.35mm in length or the equivalent of twenty-five positions

HOW TO ORDER

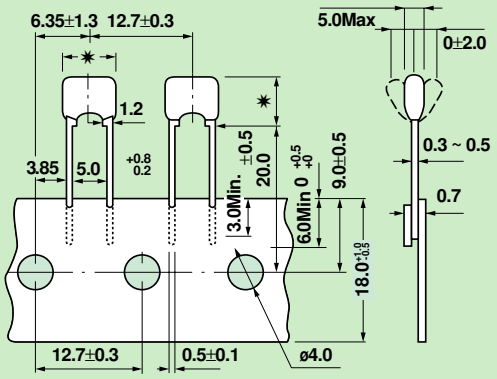
KBR - ☐ ☐ TR

① ② ③ ④

① Type: (Kyocera Bulk Resonator)
② Oscillation frequency (MHz)
③ Resonator type = M/MS/MSA/MSB/MY/MKC/MKD
④ Packaging:
TR = Tape and reel
TF = Ammo pack

TAPE DIMENSIONS

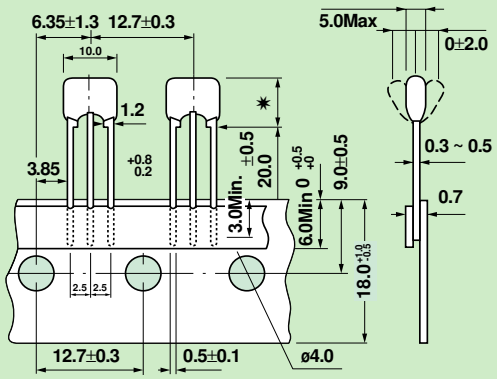
-M, -MS, -MSA, -MSB, -MY TYPES



* Varies per actual part dimensions, see pages 17 and 18.

unit: mm

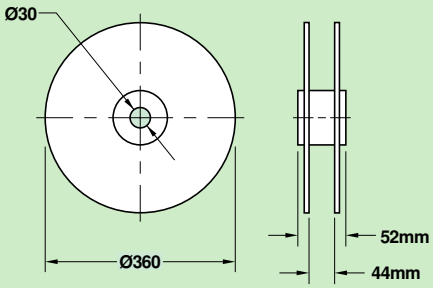
-MKC, -MKD, -MKS TYPES



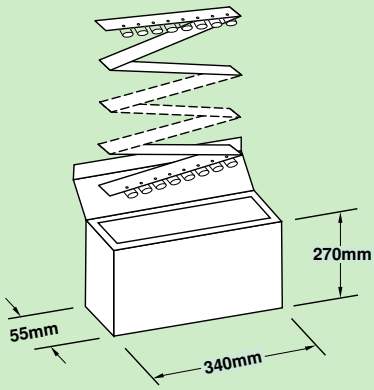
* Varies per actual part dimensions, see page 19.

unit: mm

REEL DIMENSIONS



AMMO PACK DIMENSIONS



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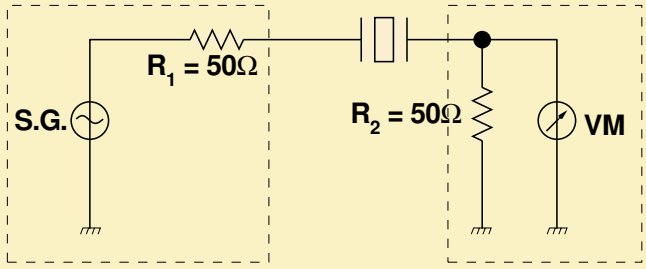
GENERAL DESCRIPTION

The fundamental wave oscillation of AVX/Kyocera Surface Acoustic Wave (SAW) Resonators eliminates spurious response, which leads to a reduction in the number of components used for spurious frequency suppression. This feature, in addition to the good shock resistance characteristics of the SAW resonator, helps to simplify the assembly process and promotes higher stability.

Kyocera Surface Acoustic Wave (SAW) resonators are ideal for use in RF modulators for videotape recorders, video discs and cable television. These unique SAW resonators contain two channels in one package. Custom design features can be manufactured for specific applications.

TEST CIRCUIT



R_1 & R_2 are input/output impedance of measuring equipment.

ENVIRONMENTAL CHARACTERISTICS

TEST	CONDITION
High Temperature Storage Test	+85±2°C
Low Temperature Storage Test	-40°±2°C
Humidity Loading Test	40±2°C, 90%RH, 6VDC
Solderability Test	260±10°C, 10±1 sec.
Thermal Shock Test	-20°C 30 min., 70°C 30 min. 5 cycles
Shock Test	90G: 6 msec XYZ direction totally 18 times

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Surface Mount SAW Resonators

PAR Series

FEATURES

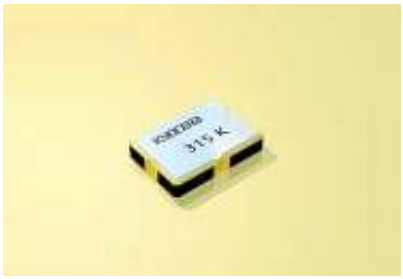
1) Frequency range: 300 to 450 MHz
2) 1 port type SMD resonator
3) Small size (5.5X3.8mm)
4) Low profile (1.5mm max)
5) SMT ceramic package
6) Excellent temperature characteristics: +100ppm ~ -250ppm (-40 ~ 85°C)
7) 2000 pieces per reel
8) Sold in increments of 2000 pieces

HOW TO ORDER

PAR S 433.92 K 04 R

① ② ③ ④ ⑤ ⑥

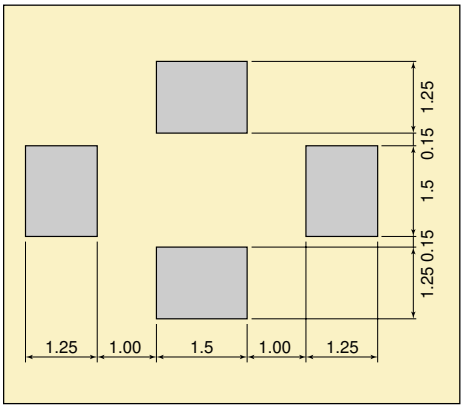
① SMT SAW Resonator
② Type: C = Glass seal, S = Seam weld
③ Frequency
④ Marking code (please see table)
⑤ Freq. Tolerance or custom spec.
00 : ±250KHz 01 : ±200KHz
02 : ±150KHz 03 : ±100KHz
04 : ±75KHz 10 : Tolerance
11 : Custom spec.
⑥ Package: R=Tape & reel



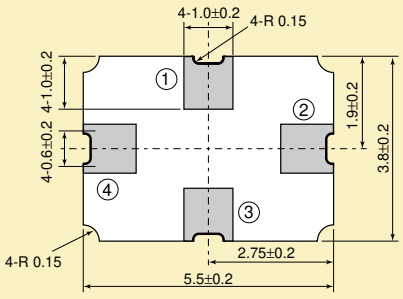
ELECTRICAL CHARACTERISTICS

Part Number	Resonant Frequency (MHz)	Resonant Loss (dB)	Parallel Capacitance (pF)
PARS 304.45LXXR	304.45	2.5 max.	4.0 max.
PARS 310.00KXXR	310.00	2.5 max.	4.0 max.
PARS 314.00KXXR	314.00	2.5 max.	3.2 max.
PARS 314.50LXXR	314.50	2.5 max.	3.2 max.
PARS 315.00KXXR	315.00	2.5 max.	3.2 max.
PARS 320.65KXXR	320.65	2.5 max.	3.2 max.
PARS 423.22KXXR	423.22	2.5 max.	3.2 max.
PARS 432.92KXXR	432.92	2.5 max.	3.2 max.
PARS 433.42LXXR	433.42	2.5 max.	3.2 max.
PARS 433.92KXXR	433.92	2.5 max.	3.2 max.

RECOMMENDED LAND PATTERN



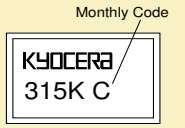
DIMENSIONS



Pin	Function
①	Hot
②	NC
③	Hot
④	NC

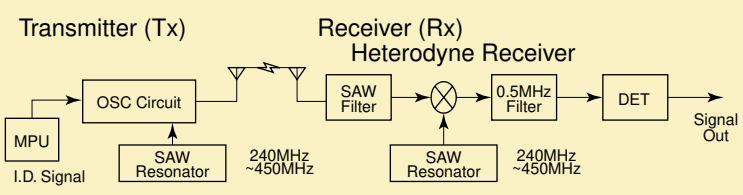
MARKING CODE

Resonant Frequency (MHz)	Marking Code
304.45	304 L
310.00	310 K
314.00	314 K
314.50	314 L
315.00	315 K
320.65	320 K
423.22	423 K
432.92	432 K
433.42	433 L



(4 digits Frequency Marking)

BLOCK DIAGRAM (Example application)



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KAR Series SAW Resonators

MHz Band SAW Resonators

f_o: 46 to 315 MHz

FEATURES

1) 2 channels encased in one package
2) Utilization of fundamental wave oscillation suppresses spurious response
3) No adjustment of peripheral circuits required
4) Good vibration and shock resistance
5) Superior temperature stability
6) Reduces the number of peripheral components

HOW TO ORDER

KAR-91-CS

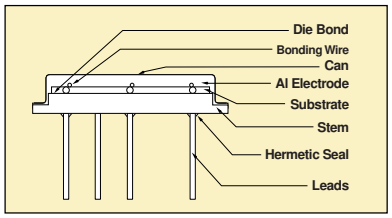
① ② ③

① Type: (Kyocera Acoustic Resonator)

② Oscillation frequency (MHz)

③ Resonator type:
CS, CT = Small package – Fig. B
CD, CB = Standard package – Fig. A
CK, CL = Round shape package – Fig. C.
CF, CG = Small square package – Fig. D.

STRUCTURE



SPECIFICATIONS (KAR-□-□)

Part No.	Channel*	Resonant Frequency (MHz)**	Resonant Loss (dB)	Parallel Capacitance (pF)	Temperature Stability -10°C to +60°C (ppm/°C)	Dimension
KAR-55CT	U-23	55.24±0.08 61.24±0.08	6.0 MAX	3.6±1 3.7±1	±8	Figure A
KAR-83CB	U-56	77.24±0.08 83.24±0.08	4.0 MAX	4.5±1 4.2±1	±7	
KAR-55CS	W-34	55.24±0.08 62.24±0.08	5.0 MAX	4.8±1 4.8±1	±8	
KAR-86CB	A-34	86.24±0.08 95.24±0.08	3.0 MAX	4.2±1 4.0±1	±5	
KAR-85CB	O-45	85.24±0.08 93.24±0.08	3.0 MAX	4.2±1 4.0±1	±5	
KAR-61CT	U-34	61.24±0.08 67.24±0.08	5.0 max	4.4±1 2.8±1	±8	Figure B
KAR-77CS	O-34	77.24±0.08 85.24±0.08	4.5 MAX	3.1±1 2.8±1	±8	
KAR-91CS	J-12	91.24±0.08 97.24±0.08	3.0 MAX	4.0±1 4.0±1	±5	
KAR-211CS	U-13	211.24±0.15	2.7 MAX	3.0±1	±8	

*J: Japan U: USA W: Germany A: Australia O: East Europe
**Other frequencies available on request.

SPECIFICATIONS (for Keyless Entry)

Part No.	Channels	Resonant Frequency (MHz)	Resonant Loss (dB)	Parallel Capacitance (pF)	Temperature Characteristics (ppm/°C)	Dimension
KAR-303CS	JPN	303.875±0.25	2.5 Max.	4.0 Max.	±8 Max.	Fig. B
KAR-304CS	US	304.30±0.25				
KAR-310CS	US	310.00±0.25				
KAR-314CS	US	314.00±0.25		3.2 Max.		
KAR-314CT	US	314.50±0.25				
KAR-315CS	US	315.00±0.25				
KAR-320CS	JPN	320.65±0.25				
KAR-345CS	US	345.00±0.25				
KAR-359CS	US	359.90±0.25				
KAR-417CS	UK	417.50±0.25				
KAR-418CS	UK	418.00±0.25				
KAR-423CS	EU	423.22±0.25				
KAR-432CS	EU	432.92±0.25				
KAR-433CS	EU	433.92±0.25				
KAR-433CT	EU	433.42±0.25				
KAR-479CS	JPN	479.50±0.5		2.3 Max.		

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SAW Resonators Sample Circuits

RF Modulators

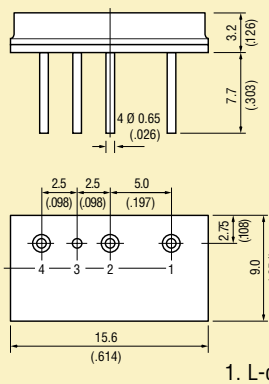
SPECIFICATIONS (for Keyless Entry)

Part No.	Channels	Resonant Frequency (MHz)	Resonant Loss (dB)	Parallel Capacitance (pF)	Temperature Characteristics (ppm/°C)	Dimension
KAR-303CK	JPN	303.875±0.25	2.5 Max.	4.0 Max.	±8 Max.	Fig. C
KAR-304CK	US	304.30±0.25				
KAR-310CK	US	310.00±0.25				
KAR-314CK	US	314.00±0.25		3.2 Max.		
KAR-314CL	US	314.50±0.25				
KAR-315CK	US	315.00±0.25				
KAR-320CK	JPN	320.65±0.25				
KAR-345CK	US	345.00±0.25				
KAR-359CK	US	359.90±0.25				
KAR-417CK	UK	417.50±0.25				
KAR-418CK	UK	418.00±0.25				
KAR-423CK	EU	423.22±0.25				
KAR-432CK	EU	432.92±0.25				
KAR-433CK	EU	433.92±0.25				
KAR-433CL	EU	433.42±0.25				
KAR-479CK	JPN	479.50±0.5		2.3 Max.		
KAR-303CF	JPN	303.875±0.25	2.5 Max.	4.0 Max.	±8 Max.	Fig. D
KAR-304CF	US	304.30±0.25				
KAR-310CF	US	310.00±0.25				
KAR-314CF	US	314.00±0.25		3.2 Max.		
KAR-314CG	US	314.50±0.25				
KAR-315CF	US	315.00±0.25				
KAR-320CF	JPN	320.65±0.25				
KAR-345CF	US	345.00±0.25				
KAR-359CF	US	359.90±0.25				
KAR-417CF	UK	417.50±0.25				
KAR-418CF	UK	418.00±0.25				
KAR-423CF	EU	423.22±0.25				
KAR-432CF	EU	432.92±0.25				
KAR-433CF	EU	433. 92±0.25				
KAR-433CG	EU	433.42±0.25				
KAR-479CF	JPN	479.50±0.5		2.3 Max.		

*JPN: Japan U: United States EU: Europe

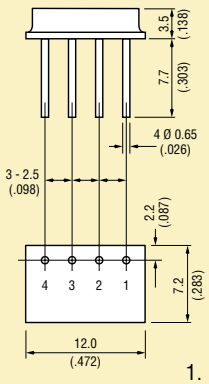
* For other frequencies, please contact your nearest sales office.

DIMENSIONS



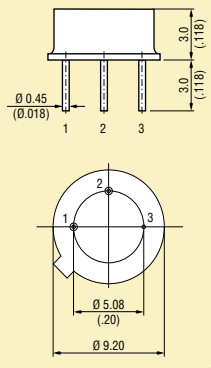
1. L-ch
2. H-ch
3. GND
4. Common

Fig. A



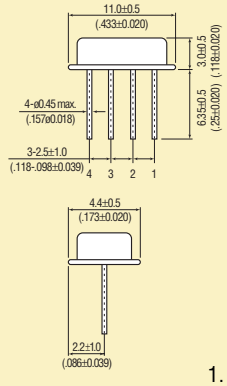
1. L-ch
2. H-ch
3. GND
4. Common

Fig. B



1. Hot
2. Hot
3. Ground

Fig. C



1. Hot
2. Ground
3. Ground
4. Hot

Fig. D

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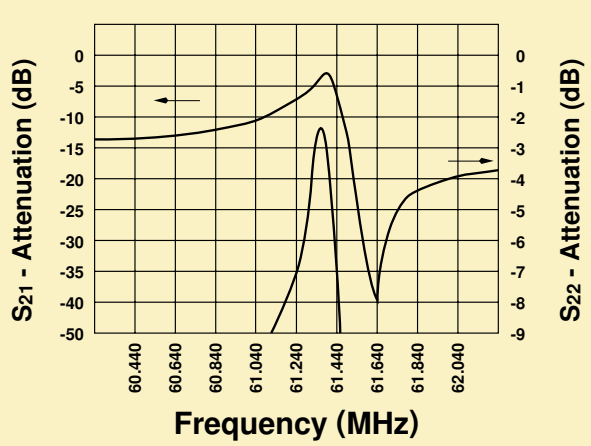
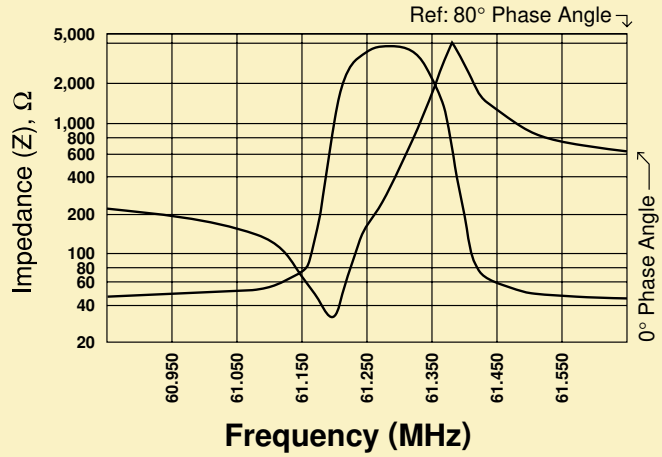
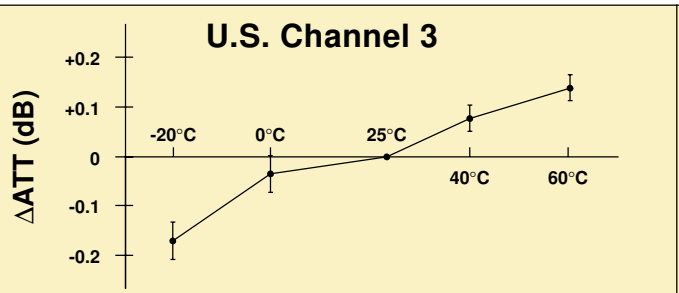
ATTENUATION vs FREQUENCY
KAR—61CT
U.S. CHANNEL 3

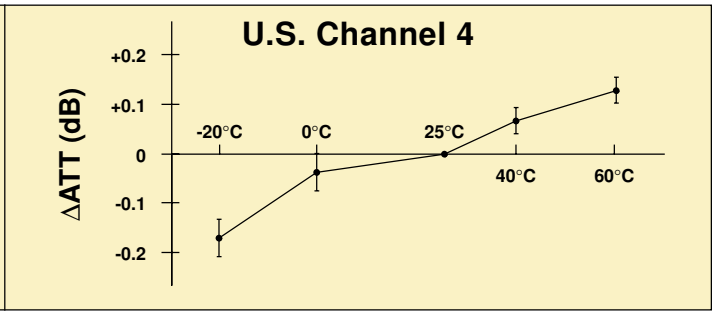


IMPEDANCE and PHASE ANGLE
KAR—61CT
U.S. CHANNEL 3

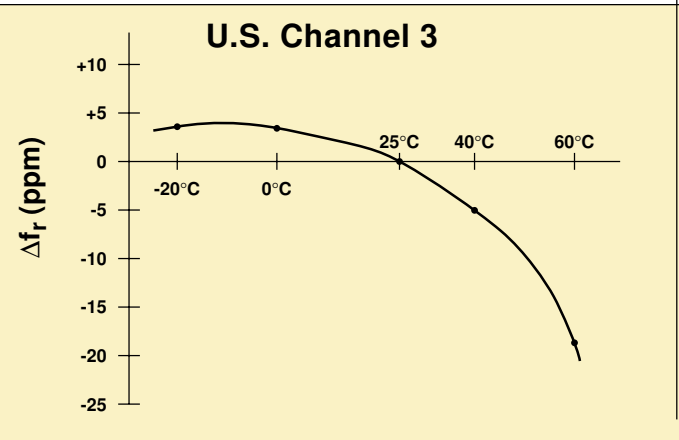


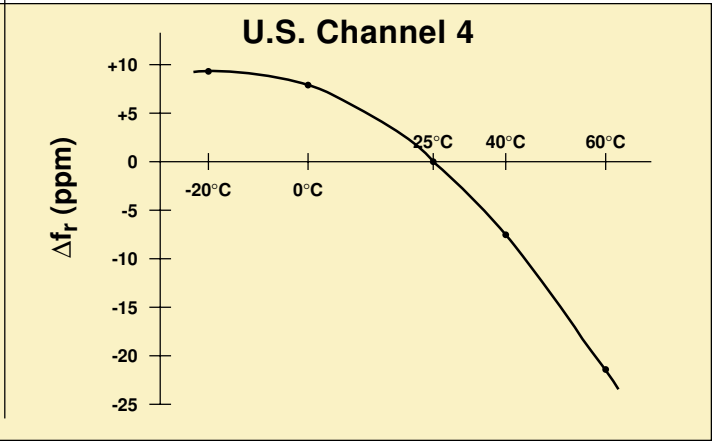
Attenuation Change at Resonance with Temperature
KAR–61CT





Resonant Frequency Change with Temperature
KAR–61CT





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MHz Band Quartz Crystals

SMD Type - KSX Series

FEATURES

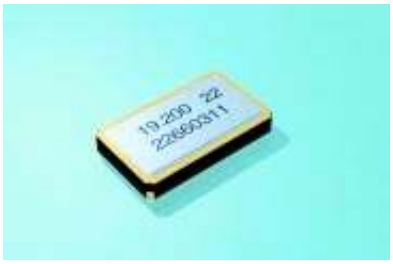
1) Reference frequency for telecommunicaton system
2) High reliability ceramic package
3) 1000 pieces per reel
4) Sold in increments of 2000 pieces

HOW TO ORDER

KSX - 36 - 192M - **

① ② ③

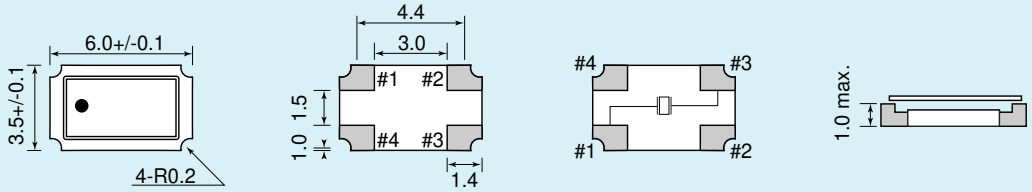
① Model: KSX-36
② Frequency: 19.2 MHz
③ Specification: 4 digits on end of part number



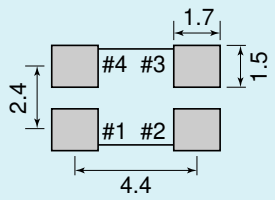
SPECIFICATIONS (KSX)

Parameters	Code	Specification	Remarks
Frequency Range	fo	12~22MHz	See available frequencies below
Load Capacitance	CL	12.0pF	
Frequency Tolerance	Δf/f	±10ppm	+25±2°C
Storage Temperature	Tstg	-40°C~+85°C	
Operating Temperature	Topr	-30°C~+80°C	
Frequency Stability vs. Temperature	Δf/T	±10ppm	-10°C~+60°C (+25°C standard)
Crystal Impedance	CI	30 (max.)	0/25/50°C & 1μW/100μW

DIMENSIONS

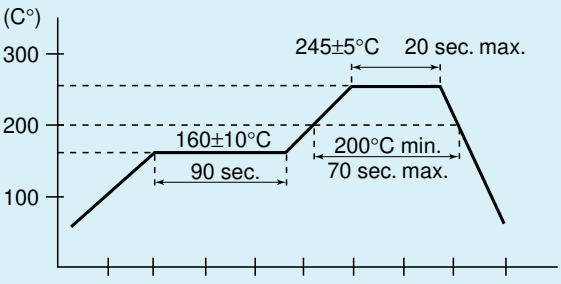


RECOMMENDED LAND PATTERN



4 Terminals type, #2 and #4 are for G.

RECOMMENDED REFLOW PROFILE



FREQUENCY (MHz)

12.00	12.600	13.000	13.8650	14.850	16.368	19.200	19.800	21.145	21.400
12.500	12.800	13.824	14.400	15.360	16.800	19.680	20.945	21.250	26.000

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MHz Band Quartz Crystals

Leaded Type - KT Series

FEATURES

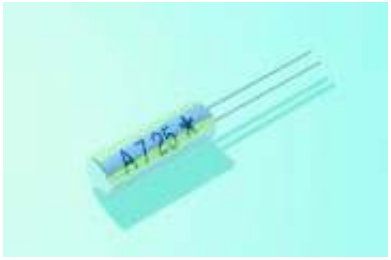
1) Reference frequency for telecommunication system
2) High stability of characteristics due to vacuum pack can
3) Reflow solderable (Drift after solder:±1ppm)
4) Bulk packaged 500 pieces/bag
5) Sold in increments of 2000 pieces

HOW TO ORDER

KT-308 - 192M **

① ② ③

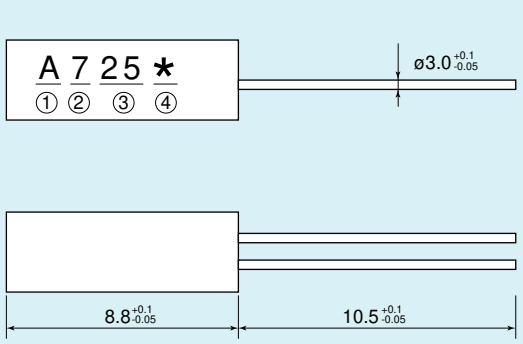
① Model: KT-308
② Frequency: 19.2MHz
③ Specification: 4 digits on end of part number

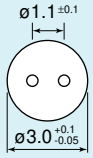


SPECIFICATIONS (KT)

Parameters	Code	Specification	Remarks
Frequency Range	fo	12~22MHz	See available frequencies below
Load Capacitance	CL	13.0pF	
Frequency Tolerance	Δf/f	±10ppm	+25±2°C
Storage Temperature	Tstg	-40°C~+85°C	
Operating Temperature	Topr	-30°C~+80°C	
Frequency Stability vs. Temperature	Δf/T	±10ppm	-10°C~+60°C (+25°C standard)
Crystal Impedance	CI	30 (max.)	-10/25/50°C & -10dbm/-30dbm

DIMENSIONS AND MARKING





A : Frequency (19.2MHz)
7 : Production Year (1997)
25: Production Week (25th week)
★ : Option

FREQUENCY (MHz)

12.00	12.800	13.824	14.400	15.360	16.800	20.945	19.800	21.250
12.600	13.000	13.8650	14.850	16.368	19.200	19.800	21.145	21.400

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GENERAL DESCRIPTION

Clock oscillators are devices which generate the pulses to control the timing and operation of logic circuitry. They differ from other components used to control the timing of logic circuits, such as quartz crystals and ceramic resonators, in that clock oscillators need a power supply but no additional external circuitry to operate. Clock oscillators are usually made by combining in a single package a frequency control device such as a quartz crystal, and a hybrid circuit of resistors, capacitors, and either transistors or an integrated circuit. The package is often either a welded steel can or ceramic package hermetically sealed which protects the crystal and electronics from environmental effects and also reduces the unwanted electromagnetic and radio-frequency emissions which oscillators can generate.

OSCILLATION DEVICES

Various types of circuits can be used to generate timing waveforms for electronic devices. The simplest of these is a simple circuit using capacitors, inductors and an active element such as a transistor or operational amplifier. This is an easy, low cost solution but the frequency is not very stable due to temperature and individual component variations. A more stable circuit would utilize a ceramic resonator, which has the advantage of better frequency tolerance, but resonators are only available in certain frequency ranges and stability of ±0.5% is the best that can be achieved. If better frequency stability is needed, then the most popular method is to use a circuit which relies on the piezoelectric properties of quartz crystals to stabilize the oscillation.

If an alternating electrical field is applied to a cut and polished quartz crystal, the crystal lattice will deform due to what is is called the piezoelectric effect. At one particular frequency, which is determined by the geometry and size of the crystal, vibration will occur much more easily than at any other frequency. This is called the “resonant” frequency. If an oscillation circuit is built around this crystal, the mechanical vibrations can be used to control the electrical oscillations very precisely.

AVX/Kyocera builds its high quality clock oscillators from the substrate up. The whole module is hermetically sealed into an all-metal welded package to protect it from humidity. The case is directly grounded into a pin to help minimize RF radiation and meet FCC’s EMI specifications.

A full range of clock oscillators are manufactured by AVX/Kyocera. These extend from 1 MHz up to 72 MHz and include TTL and HCMOS compatible drive levels. AVX/Kyocera also offers special low power consumption clocks for long life battery applications. (See chart page 28.) Application specific designs for critical requirements of today’s high-speed, 32-bit microprocessors are available.

WAVEFORM

The diagram below shows a typical waveform of a clock oscillator with an explanation of the parameters important for correct selection of the appropriate device.

Often called the symmetry of a waveform, duty cycle is a measure of how close to being equal the high and low parts of a waveform are. A perfectly symmetrical waveform will have duty cycle of 50%. We usually specify the minimum and maximum variations of the duty cycle as, for example: 60/40%. This is computed from the times shown on the diagram below as A /A+B.

Series	Output Frequency (MHz)	Fan Out	Output Level		Features
			V_{OH} Min	V_{OL} Max	
TTL					
K50 -HC* -C †	8 to 68	50pF	0.9 V_{DD}	0.1 V_{DD}	CMOS/TTL Drive
KXO -01	8 to 50	10 TTL	2.4	0.4	Cost Performance
KXO -HC* -T (KHO -HC* -T)	1 to 72	10 TTL	2.4	0.4	Versatile Drive Capabilities
HCMOS					
K50 -HC* -C †	8 to 68	50pF	0.9 V_{DD}	0.1 V_{DD}	CMOS/TTL Drive
K50 -CS* -SE	8 to 50	15pF	V_{DD}-0.5	0.5	Low Power Consumption
KXO -HC* -C (KHO -HC* -C)	1 to 72	50 pF	0.9 V_{DD}	0.1 V_{DD}	Versatile Drive Capabilities
386 -HC	24,32,40,50	7 TTL	0.9V_{DD}	0.1 V_{DD}	Drives 80386
Low Voltage					
K50 -3C (3.3V)	8 to 68	15pF	0.9 V_{DD}	0.1 V_{DD}	Low Supply Voltage

†Will also drive TTL. See catalog for details – page 31.

Cordless & Cellular Phones		Output	Features
Temperature Compensated	Frequency (MHz)		
KT11	12.8, 13.0, 14.4, 14.85, 15.36, 16.8, 19.2	1Vp-p/10k /10pF	Surface Mount
KT12	12.8, 13.0, 14.4, 16.8, 19.2, 19.68	1Vp-p/10k /10pF	Miniature Surface Mount
KT14	13.0, 14.4, 14.85, 16.8, 19.2, 19.44, 19.68, 19.8	1Vp-p/10k /10pF	Ultra Low Profile Surface Mount
VCO	200~2000		High Performance Surface Mount

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GENERAL DESCRIPTION continued

CLOCK OSCILLATOR APPLICATIONS

In a typical personal computer system 5 or 6 clock oscillators may be used in the main processing unit, for all the add-on boards, video graphics adapters, co-processors, etc., and all the peripheral devices such as printers, modems and networking equipment. Many different companies may be involved in the manufacture of all these individual parts of the system.

The telecommunications industry uses clock oscillators in fax machines, cellular phones, pagers, and radio systems. These oscillators are typically very high precision, temperature compensated and voltage controlled devices.

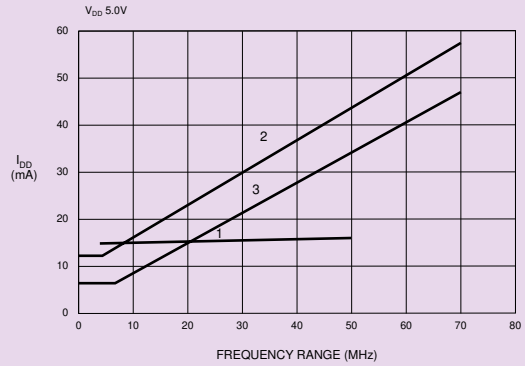
Clock oscillators are manufactured by combining a quartz crystal into a hybrid module containing passive components and active digital devices.

AVX/Kyocera builds its high quality clock oscillators from the substrate up. The whole module is hermetically sealed into an all-metal welded package to protect it from humidity. The case is directly grounded to a pin to help minimize RF radiation and meet FCC's EMI specifications.

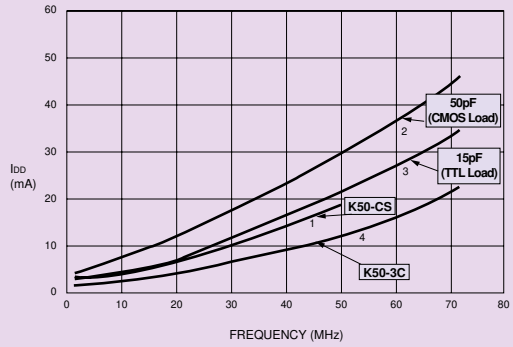
PACKAGING

The diagrams below show the basic design of the 14 pin and 8 pin DIP (dual inline packages) and ceramic SMT packages in which most of the clock oscillators are available. Leaded oscillators are tube packaged. SMT K50 units are tape and reel packaged 1000 units per reel. Tube packages hold 25 units each for the KXO-01 and KXO-HC series, and 40 units each for the KHO-HC series products.

FREQUENCY vs. POWER SUPPLY CURRENT

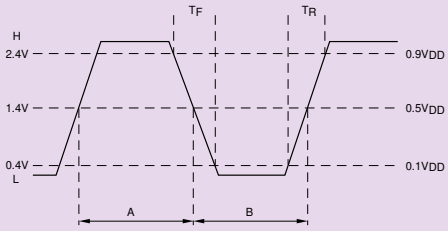


1. KXO-01
2. KXO-HC-C/KHO-HC-C
3. KXO-HC-T/KHO-HC-T



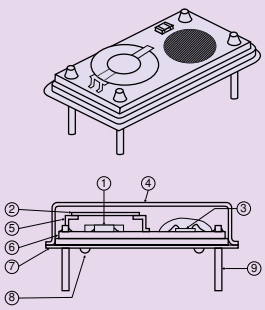
1. K50-CS
2. K50-HC-C (CMOS Compatible)
3. K50-HC-C (TTL Compatible)
4. K50-3C

OUTPUT WAVEFORM



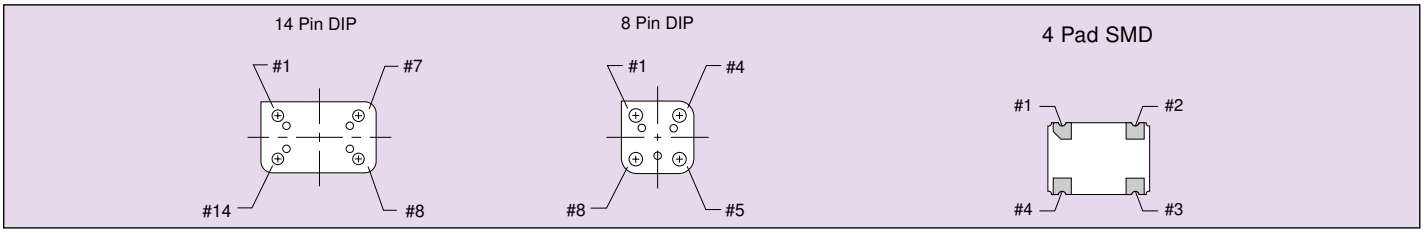
$$\text{Duty Ratio} = \frac{A}{A+B}$$

CLOCK OSCILLATOR GENERAL CONSTRUCTION



1	Chip components
2	Crystal
3	IC
4	Cap
5	Crystal supporter
6	Thick film substrate
7	Stem
8	Stand-off
9	Lead pin

PACKAGES



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MECHANICAL

Readings to be made one hour after completion of test.

Shock Resistance - Drop module onto a hard wooden surface from a height of 50cm, three times. Unit must meet initial electrical requirements after test.

Vibration Resistance - Vibrations with an amplitude of 1.5mm and a sweep between 10 and 55Hz of 1 minute shall be applied for 2 hours in each of the X, Y, and Z axes for a total test time of 6 hours. Unit must meet initial electrical requirements after test.

Pin Pull and Bend - A load of 1kg shall be applied for 30 seconds in the direction of each pin. The pin will withstand without damage a bend from its base of 90° in one direction twice. Unit must meet initial electrical requirements after test.

Solvent Resistance - After immersion in Freon TF, Freon TE or IPA Liquid, at 25±5°C for a period of 10 minutes, unit shall meet initial electrical requirements.

Ultrasonic Resistance - Unit shall withstand ultrasonic washing at 28 to 31kHz and 300 watts per 20 liters of fluid in either Freon TF, Freon TE or IPA for up to 30 seconds without damage.

ENVIRONMENTAL

Readings to be made two hours after completion of test.

Soldering Heat - Immerse pin to within 1mm of the glass stand-off in a solder bath of 280±10°C for 10 seconds. Unit shall meet initial electrical requirements after test.

Heat Resistance - After exposure to +85°C for 500 hours, frequency change shall be within ±10ppm of initial value.

Cold Resistance - After exposure to -40°C for 500 hours, unit must meet initial electrical requirements.

Humidity Resistance - After exposure to +85°C and 85% RH for 500 hours, unit must meet initial electrical requirements and show no significant rusting.

Thermal Shock - After 15 cycles of immersions in baths of 100°C and 0°C for 5 minutes with transfer times within 10 seconds, units will meet initial electrical requirements.

Hermeticity - Helium leak detector test should be performed under 5 x 10^{-7} atm, and measured after application of 10kg/sq cm of pressure for three hours and exposure to air for 30 minutes. No air bubbles shall be found when immersed in 75°C water for 5 minutes.

AVX/Kyocera Crystal Clock Oscillator

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K50-HC-C Series Miniature SMT Crystal Clock Oscillators

HCMOS Compatible

f_o: 8 to 68 MHz

Features:

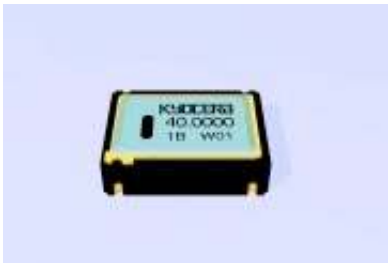
1) Miniature SMT ceramic package
2) Frequency: 8~68MHz
3) Stability: 100ppm, 50ppm
4) Load: 50pF maximum
5) Tristate output inhibit
6) Hermetically sealed package
7) 1000 pieces per reel
8) Sold in increments of 1000 pieces

How to Order

K50-HC 1 CS E 40.0000M R

① ② ③ ④ ⑤ ⑥

① Type: (K50-HC series)
② Stability: 1-100ppm, 0-50ppm
③ Output compatibility:
CS = CMOS 45/55 duty cycle @ 50% V_{DD}
CS = TTL 40/60 duty cycle @ 1.4 volts
④ Tristate output: E with function
⑤ Frequency (MHz)
⑥ Packaging: R=Tape and reel

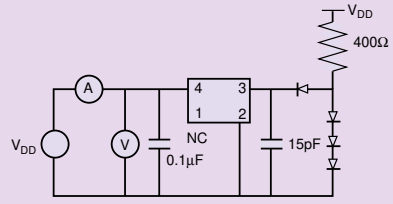


SPECIFICATIONS (K50-HC)

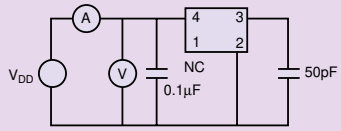
		TTL Output		CMOS Output		
Parameters	**Code**	**Rating**	**Remarks**	**Rating**	**Remarks**	**Unit**
Output Frequency	f_{OUT}	8~68		8~68		MHz
Frequency precision	Δf/f	1=100, 0=50	-10 to 70°C, V_{DD}=5±0.5V	1=100, 0=50	-10 to 70°C, V_{DD}=5±0.5V	ppm
Operating temp.	t_{OPR}	-10 to +70		-10 to +70		°C
Storage temp.	t_{STOR}	-55 to +125		-55 to +125		°C
Supply voltage	V_{DD}	5 ±0.5		5 ±0.5		V
Supply current	I_{DD}	40 max @ 10TTL/15pF	25°C, 50MHz	50 max @ 50pF	25°C, 50MHz	mA
Duty cycle	S_Y	40/60	at 1.4 volts	45/55	@50%V_{DD}	%
Output "0" level	V_{OL}	0.4max	@I_{OL} = 16mA	0.5max	@I_{OL} = 16mA	V
Output "1" level	V_{OH}	2.4min	@I_{OH} = -1mA	V_{DD}-0.5min	@I_{OH} = -1mA	V
Rise / Fall time	T_R/T_F	5max	0.4V-2.4V	10max	10-90%V_{DD}, 50pF	nS
Load		fo≤50MHz=50pF fo>50MHz=15pF		fo≤50MHz=50pF fo>50MHz=15pF		
Enable/disable time		100max		100max		nS
Aging rate		±5max		±5max		ppm/y
Input voltage-high	V_{IH}	2.2min		2.2min		V
Input voltage-low	V_{IL}	0.8max		0.8max		V

TEST CIRCUIT

TTL Output

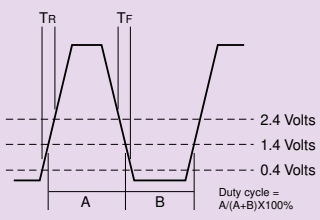


CMOS Output

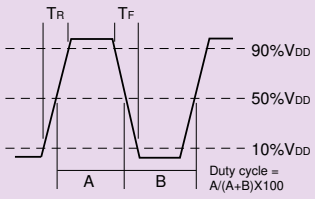


OUTPUT WAVEFORM

TTL Output



CMOS Output



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K50-3C Series Miniature SMT Crystal Clock Oscillators

3.3 Volt

f_o: 8 to 68 MHz

Features

1) 3.3 volt operation
2) Tristate output inhibit and oscillation shutdown to reduce power supply current draw
3) Miniature SMT ceramic package
4) Frequency: 8 to 68MHz
5) Stability: 100ppm
6) Load: up to 15pF
7) Hermetically sealed package
8) 1000 pieces per reel
9) Sold in increments of 1000 pieces

How to Order

K50-3C 1 E 40.0000M R

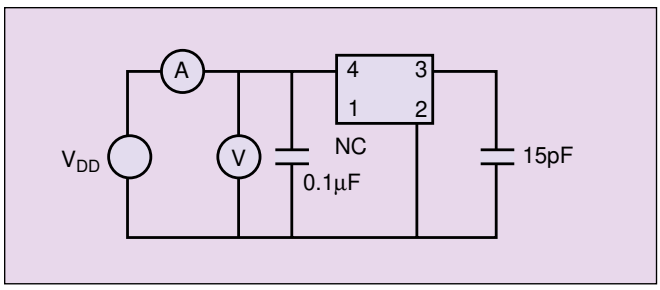
① ②③ ④ ⑤

① Type: (K50-3C series)
② Stability: 1-100ppm
③ Tristate o/p and shutdown: E with function
④ Frequency (MHz)
⑤ Packaging: R=Tape and reel

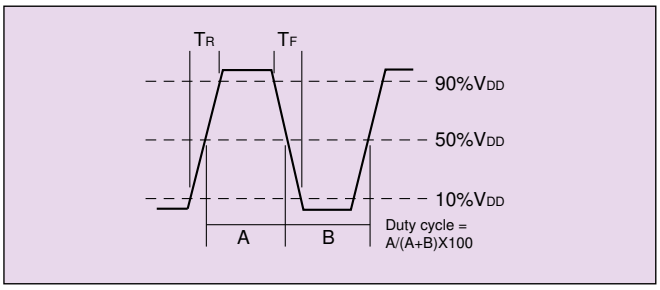
SPECIFICATIONS (K50-3C)

Parameters	Code	Rating	Unit	Remarks
Output Frequency	f_{OUT}	8 to 68	MHz	
Frequency precision	$D_{F/F}$	1=100, 0=50	ppm	-10 to 70°C, V_{DD}=3.3±10%
Operating temp	t_{OPR}	-10 to +70	°C	
Storage temp	t_{STOR}	-55 to +125	°C	
Supply voltage	V_{DD}	3.3 ±10%	V	
Supply current(1)	$I_{DD(1)}$	25 max @ 15pF	mA	25°C, 68MHz
Supply current(2)	$I_{DD(2)}$	100 max	µA	Oscillation shutdown (pad #1= low, pad #3=high imp.)
Duty cycle	S_Y	40/60	%	@50%V_{DD}
Output "0" level	V_{OL}	10% V_{DD} max	V	@15pF load
Output "1" level	V_{OH}	90%V_{DD} min	V	@15pF load
Rise / Fall time	T_R/T_F	10max	nS	10%-90%V_{DD}, 15pF
Load		15max	pF	or 5LSTTL
Enable/disable time		5	mS	8.0000 to 32.0000MHz
		150max	nS	32.0001 to 50.0000MHz
		5	mS	50.0001 to 68.0000MHz
Aging rate		±5max	ppm/y	
Input voltage-high	V_{IH}	2.0min	V	V_{DD} = 3.3V, I_{IH} = 10µA
Input voltage-low	V_{IL}	0.5max	V	

TEST CIRCUIT



OUTPUT WAVEFORM



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K50-CS Series Miniature SMT Crystal Clock Oscillators

Low Power Consumption

f_o: 8 to 50 MHz

Features

1) Miniature SMT ceramic package
2) Low power consumption
3) Frequency: 8-50MHz
4) Stability: 100ppm, 50ppm
5) Load: 15pF
6) Tristate output inhibit
7) Hermetically sealed package
8) 1000 pieces per reel
9) Sold in increments of 1000 pieces

How to Order

K50-CS 1 S E 40.0000M R

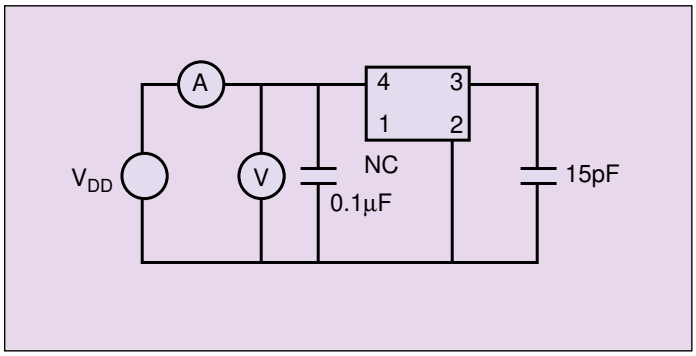
① ② ③ ④ ⑤ ⑥

① Type: (K50-CS series)
② Stability: 1-100ppm, 0-50ppm
③ Duty cycle: S-45/55
④ Tristate o/p: E with function
⑤ Frequency
⑥ Packaging: R=Tape and reel

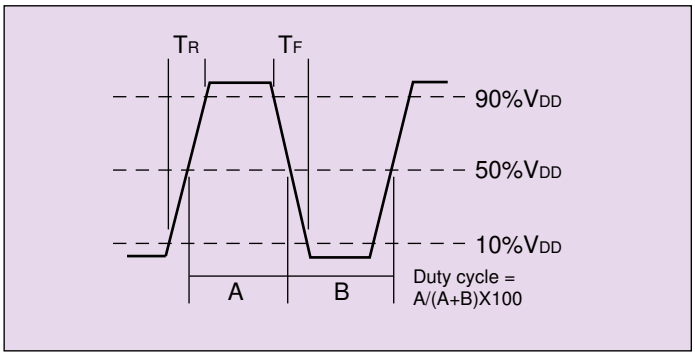
SPECIFICATIONS (K50-CS)

Parameters	Code	Rating	Unit	Remarks
Output Frequency	f_{OUT}	8 to 50	MHz	
Frequency precision	Δf/f	1=100, 0=50	ppm	-10 to 70°C, V_{DD}=5±0.5V
Operating temp	t_{OPR}	-10 to +70	°C	
Storage temp	t_{STOR}	-55 to +125	°C	
Supply voltage	V_{DD}	5 ±0.5	V	
Supply current	I_{DD}	30 max @ 15pF	mA	25°C, 50MHz
Duty cycle	S_Y	45/55	%	@50%V_{DD}
Output "0" level	V_{OL}	0.1V_{CC} max	V	@I_{OL} = 4.0mA
Output "1" level	V_{OH}	0.9V_{CC} min	V	@I_{OH} = -4.0mA
Rise / Fall time	T_R/T_F	10max	nS	0.1V_{CC}-0.9V_{CC}
Load		15max	pF	
Enable/disable time		100max	nS	
Aging rate		±5max	ppm/y	
Input voltage-high	V_{IH}	2.2min	V	
Input voltage-low	V_{IL}	0.8max	V	

TEST CIRCUIT



OUTPUT WAVEFORM



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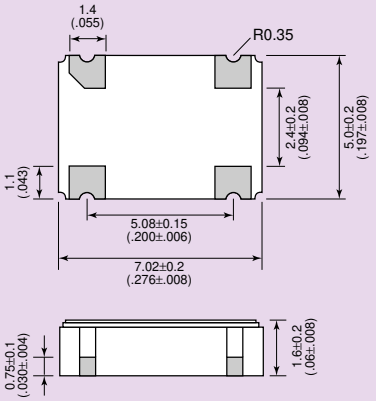
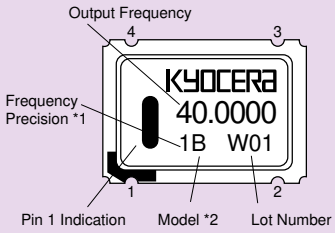
K50 Series Miniature SMT Clock Oscillators

Ceramic Package

DIMENSIONS





Pad #	Function
1	Output Disable*
2	GND/ Case GND
3	Output
4	$+V_{DD}$

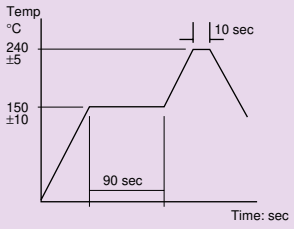
*Logic "0" disables o/p

*Marking: *1) 1 = 100ppm, 0 = 50ppm. *2) A = CS-E, B = HC-CSE, L = 3C-LE (3.3 volt)

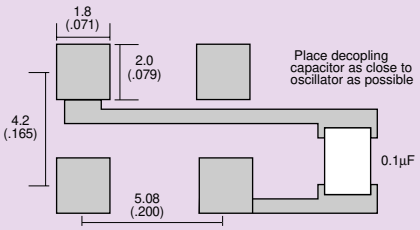
Units: mm (inches)

SOLDERING

Suggested IR Reflow Profile

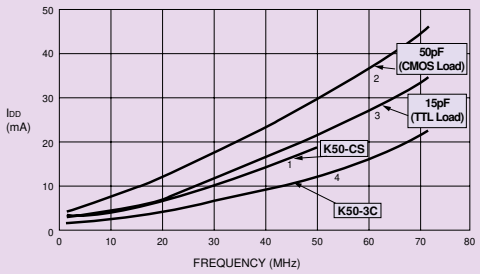


Suggested Solder Pad Layout



Units: mm (inches)

FREQUENCY VS. POWER SUPPLY CURRENT



ENABLE/DISABLE FUNCTION CHART

K50-HC-C, K50-CS Series

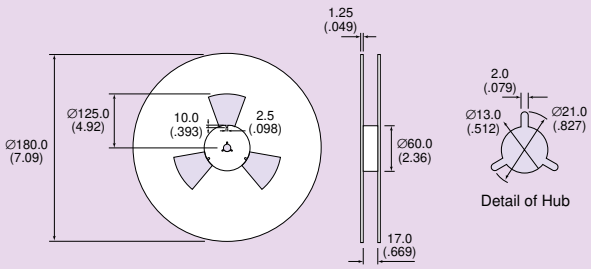
#1 Pad	#3 Pad
High or Open	Oscillation
Low	High Impedance

K50-3C-L Series

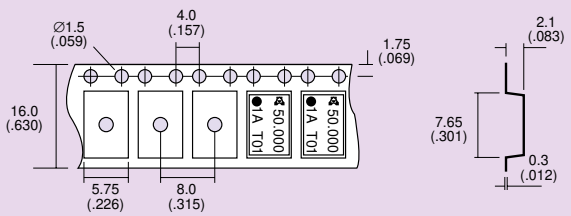
#1 Pad	#3 Pad
High	Oscillation
Low	High Impedance Oscillation Stops

PACKAGING

Reel Dimensions



Embossed Carrier Tape Dimensions



Units: mm (inches)

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KT11 Series SMT Crystal Clock Oscillators

Temperature Compensated

FEATURES

1) Frequency adjustment free after reflow soldering process
2) Ultra miniature type (11X9X4mm)
3) AFC function available (option)
4) 3V/5V drive available
5) 1000 pieces per reel
6) Sold in increments of 1000 pieces

HOW TO ORDER

KT11 - E G R 30 N - 19.200M T

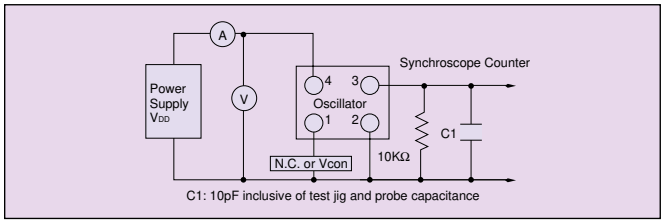
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Type
② Frequency precision: D=±2ppm, E=±2.5ppm, K=±5ppm
③ Lower temperature limit: C=-30°C; E=-20°C, G=-10°C
④ Upper temperature limit: R=60°C; T=70°C; V=80°C
⑤ Supply voltage: 30=3.0V; 50=5.0V
⑥ AFC function; V=with; N=without; L=with (trimmerless)
⑦ Frequency: See table below.
⑧ Packaging: T=Tape and reel

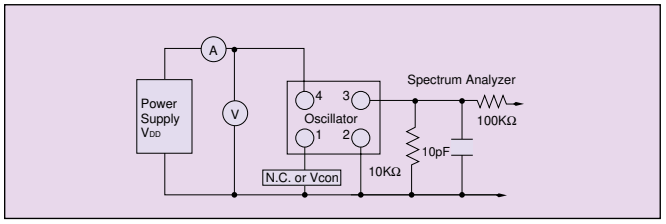
SPECIFICATIONS

Frequency		19.200MHz/PHS	12.8, 13.0, 14.4, 14.85, 15.36, 15.9, 16.8MHz/Cellular
V_{DD}		3V±5%	3V or 5V±5%
Output (10k /10pF)		1.0Vp-p min.	1.0Vp-p min.
Current consumption (no load)		2.0mA max.	2.0mA max.
Frequency stability (Δf/fa)	**Temperature**	±2.5ppm (-10~+60°C)	±5.0, ±2.5, ±2.0ppm max. (-30~+80°C)
	Load (10pF/10kΩ ±10%)	±0.2ppm max.	±0.2ppm max.
	Voltage (3.0V ±5%)	±0.3ppm max.	±0.3ppm max.
Trimmer adjustment (Δf/fa)		±3.0ppm min.	±3.0ppm min.
Voltage control (1.5V±1.0V)Δf/V		±4~±8ppm (±30ppm:Trimmerless type)	±4~±8ppm (±30ppm:Trimmerless type)
Spurious ratio		-3dBc max.	-3dBc max.
Aging		±1.0ppm / y max.	±1.0ppm / y max.

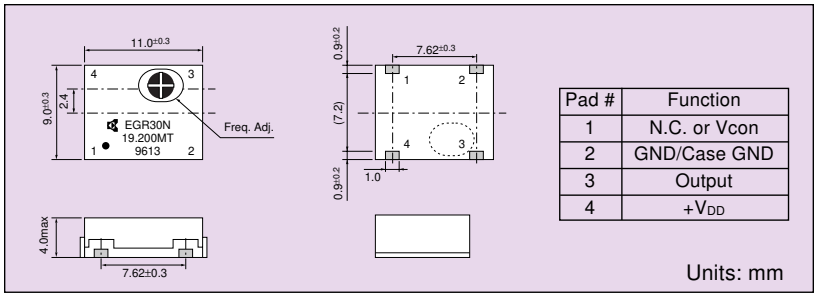
TEST CIRCUIT (EXCEPT FOR HARMONIC)



TEST CIRCUIT (HARMONIC)



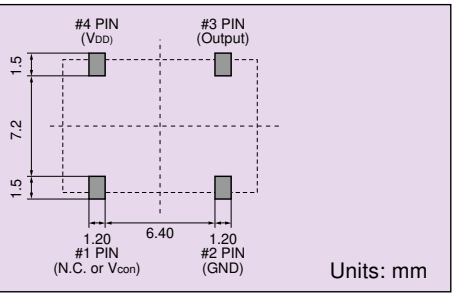
DIMENSIONS



Pad #	Function
1	N.C. or Vcon
2	GND/Case GND
3	Output
4	+V_{DD}

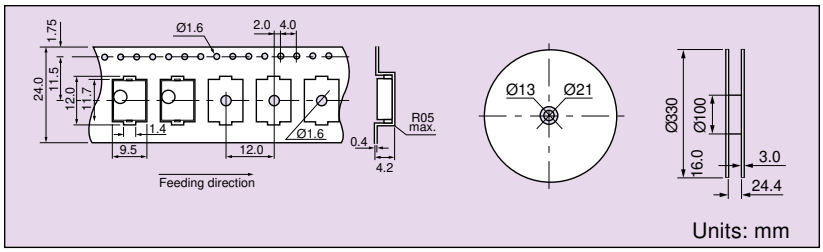
Units: mm

RECOMMENDED PAD LAYOUT



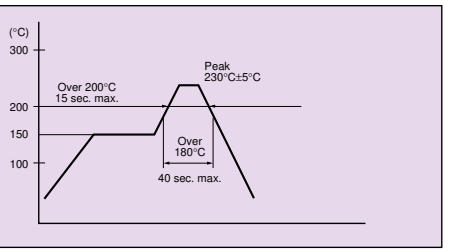
Units: mm

TAPING DIMENSIONS



Units: mm

RECOMMENDED REFLOW PROFILE



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KT12 Series SMD Crystal Clock Oscillators

Temperature Compensated

FEATURES

1) Miniature SMD type (11.6x9.6x2.3mm)
2) Frequency adjustment free after reflow soldering process
3) AFC function available (option)
4) 3V/5V drive available
5) Frequency stability: ±2ppm at -30~+80°C
6) 2000 pieces per reel
7) Sold in increments of 2000 pieces

HOW TO ORDER

KT12 □ - D C V 33 V - 19.680M T

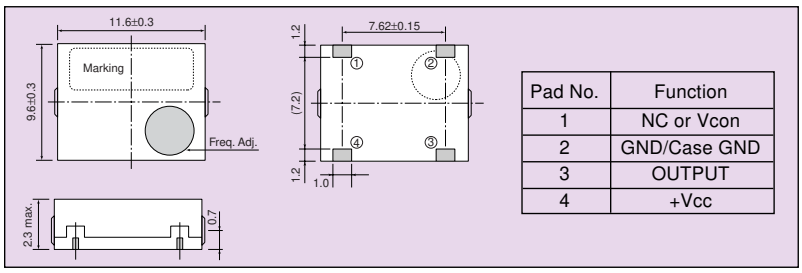
① ② ③④⑤ ⑥ ⑦ ⑧ ⑨

① Type
② Terminals: Blank (□)=4 terminals, A=6 terminals B=8 terminals
③ Frequency stability: D=±2ppm, E=±2.5ppm, K=±5ppm
④ Lower operaing temp.: C=-30°C; E=-20°C, G=-10°C
⑤ Upper operating temp.: R=60°C; T=70°C; V=80°C
⑥ Supply voltage: 30=3.0V; 50=5.0V
⑦ AFC function; V=with; N=without; L=with (trimmerless)
⑧ Frequency: See table below
⑨ Packaging: T= Tape and reel

SPECIFICATIONS

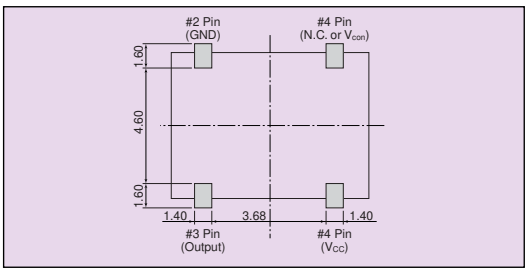
Parameters	Code	Specification			Unit	Remarks
		PHS	Cellular			
Supply Voltage	Vcc	3.0V±5%	3.0V±5%		V	
			5.0V±5%			
Output Frequency	Fout	19.200	19.680	19.200	MHz	—
			16.800	14.400		
			13.000	12.800		
Operating Temp.	Topr	-10 ~ 60	-30 ~ 80 max.		°C	—
Storage Temp.	Tstr	-20 ~ 70	-40 ~ 85		°C	—
Frequency Stability	f/fo	±2.5 max.	±2.0 max.		ppm	vs. Temp. (After Reflow)
			±2.5max.			
		±0.2 max.				vs. Load
		±0.3 max.				vs. Voltage
Aging Rate	Aging	±1.0 max.			ppm/year	1 Year
Output Voltage	Vout	1.0 min.			Vp-p	Load 10k /10pF
Supply Current	Icc	2.0 max.			mA	—
Trimmer Control Range	f/C	±3.0 min.			ppm	Internal Trimmer
Voltage Control Range	f/V	ex: ±4.0 ~ ±8.0			ppm	1.5V±1V, 2.5±1V
Harmonics	—	-3.0 max.			dBc	—

DIMENSIONS

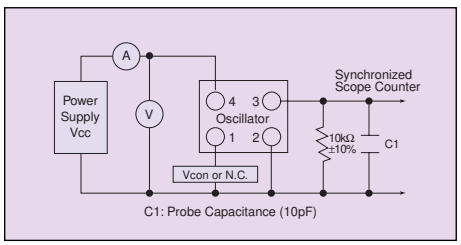


Pad No.	Function
1	NC or Vcon
2	GND/Case GND
3	OUTPUT
4	+Vcc

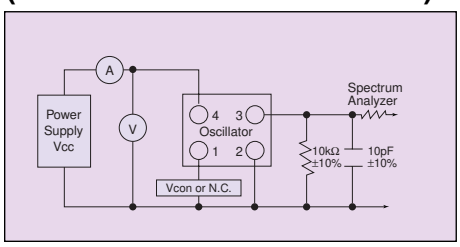
RECOMMENDED LAND PATTERN



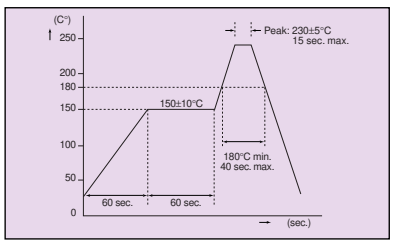
TEST CIRCUIT (AMPLITUDE)



TEST CIRCUIT (HARMONICS & FREQUENCY)



RECOMMENDED REFLOW PROFILE (IR REFLOW)



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KT14 Series SMD Crystal Clock Oscillators

Temperature Compensated

FEATURES

1) Ultra low profile SMD type (9.0x7.0x1.7mm)
2) Frequency adjustment free after reflow soldering process
3) AFC function available (option)
4) 2.8, 3.0, 3.3V drive available
5) 2000 pieces per reel
6) Sold in increments of 2000 pieces

HOW TO ORDER

KT14 - E C T 28 L - 19.440M T

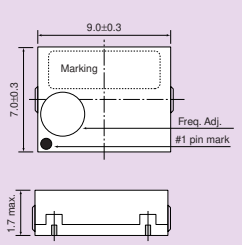
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Type
② Frequency stability: D=±2ppm, E=±2.5ppm, K=±5ppm
③ Lower operating temp.: C=-30°C; E=-20°C, G=-10°C
④ Upper operating temp.: R=60°C; T=70°C; V=80°C
⑤ Supply voltage: 28=2.8V; 50=3.0V
⑥ AFC function; V=with; N=without; L=with (trimmerless)
⑦ Frequency: See table below.
⑧ Packaging: T=Tape and reel

SPECIFICATIONS

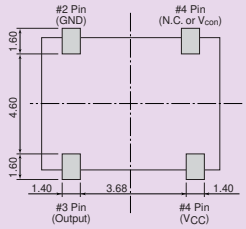
Parameters	Code	Specification			Unit	Remarks
		PHS	Cellular			
Supply voltage	Vcc	2.8V±5%	2.8V±5%		V	—
			3.0V±5%			
			3.3V±5%			
Output Frequency	Fout	19.200	13.000	14.400	MHz	—
			14.850	16.800		
			19.200	19.440		
			19.680	19.800		
Operating Temp.	Topr	-10 ~ 60	-30 ~ 80 max.		°C	—
Storage Temp.	Tstr	-20 ~ 70	-40 ~ 85		°C	—
Frequency Stability	f/fo	±2.5 max.	±2.0 max.		ppm	vs. Temp. (After Reflow)
			±2.5 max.			
		±0.2 max.				vs. Load
		±0.3 max.				vs. Voltage
Aging Rate	Aging	±1.0 max.			ppm/year	1 Year
Output Voltage	Vout	1.0 min.			Vp-p	Load 10K /10pF
Supply Current	Icc	2.0 max.			mA	No Load
Trimmer Control Range	f/C	±3.0 min.	—		ppm	—
Voltage Control Range	f/V	—	ex: ±8.0 ~ ±15.0		ppm	1.5V±1V, 2.5±1V
Harmonics	—	-3.0 max.			dBc	—

DIMENSIONS

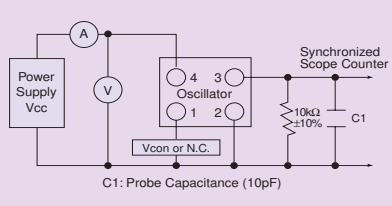


Pad No.	Function
1	NC or Vcon
2	GND/CASE GND
3	OUTPUT
4	+Vcc

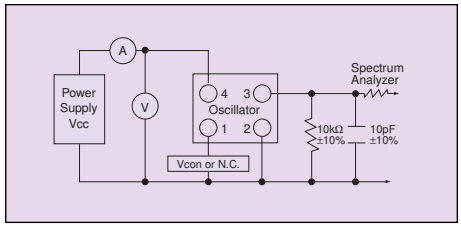
RECOMMENDED LAND PATTERN



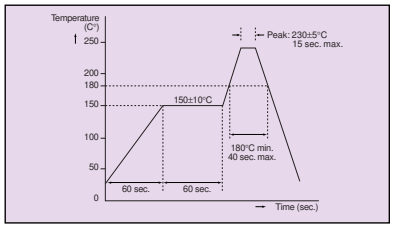
TEST CIRCUIT (AMPLITUDE)



TEST CIRCUIT (HARMONICS & FREQUENCY)



RECOMMENDED REFLOW PROFILE (IR REFLOW)



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Voltage Control Oscillator

VK Series - Surface Mount

f_o: 100 to 700 MHz

FEATURES

1) Covers UHF band
2) For PDC mixing and PHS 2nd local
3) Available 2.2V, 3mA typ.
4) Small (9x7mm)
5) Low profile (2.00mm max.)
6) 2000 pieces per reel
7) Sold in increments of 2000 pieces

HOW TO ORDER

VK - 120 R 0130 A1 W

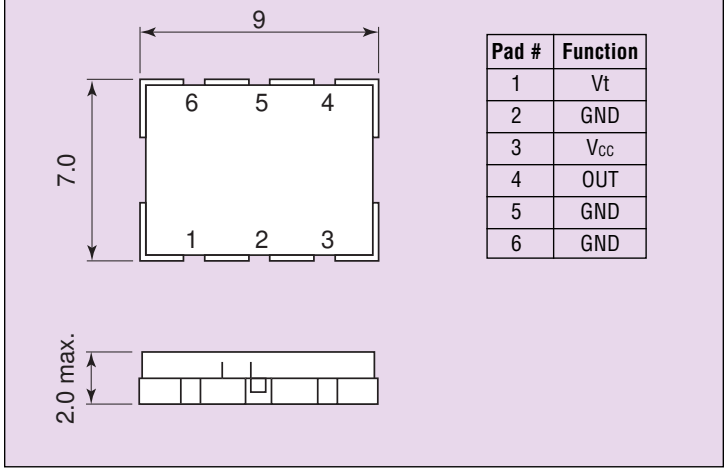
① ② ③ ④ ⑤ ⑥

① Series: VK=100~700MHz
② Dimensions: 120=9x7mm
③ Applications: R=RX
④ Frequency: 0130=130MHz
⑤ Individual specification
⑥ Packaging: W = Tape and reel

SPECIFICATIONS

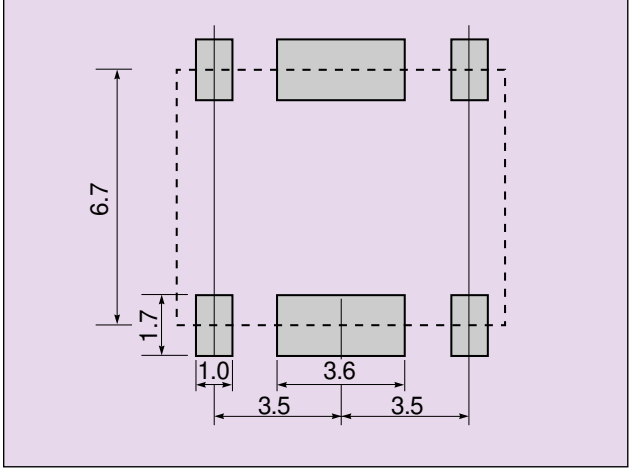
Parameters	Specifications	Unit	Condition
Supply Voltage	2.2±0.2	V	—
Current Consumption	4.0	mA	Ta=25±5°C Vcc=2.2±0.05[V]
Frequency	129.545	MHz	Vt=0.5 ~ 2.5V
Output Level	-3±3	dBm	Ta=25±5°C Vcc=2.2±0.05[V]
Tuning Voltage Sensitivity	2.5±1.0	MHz/V	[f(2.5) - f(0.5)]/2.0
C/N (Phase Noise)	70	dBc	off-set 25kHz 16kHz B.W.
PSU Stability	±200	kHz	Vcc=2.2V ±0.2V
Temperature Stability	±1	MHz	-20 ~ +70°C @25°C
Pulling Stability	±200	kHz	VSWR=2 All phase
Spurious Level	-10	dBc	Reference is fundamental, Harmonics Level
Operating Temp. Range	-20 ~ 70	°C	—

DIMENSIONS and PAD CONNECTION



Pad #	Function
1	Vt
2	GND
3	Vcc
4	OUT
5	GND
6	GND

RECOMMENDED LAND PATTERN



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Voltage Control Oscillator

EK Series - Surface Mount

f_o: 700 to 1300 MHz

FEATURES

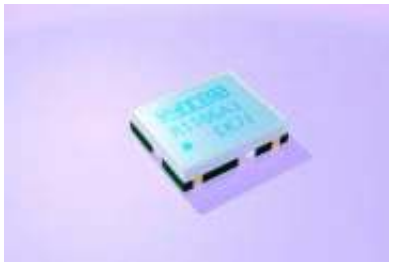
1) High reliability construction
2) Reflow soldering available
3) High performance for C/N and S/N
4) 2000 pieces per reel
5) Sold in increments of 2000 pieces

HOW TO ORDER

EK - 304 R 0972 AA W

① ② ③ ④ ⑤ ⑥

① Series: EK=700~1300MHz
② Dimensions
③ Applications: R=RX
④ Frequency: 0927=927MHz
⑤ Individual specification
⑥ Packaging: W = Tape and reel

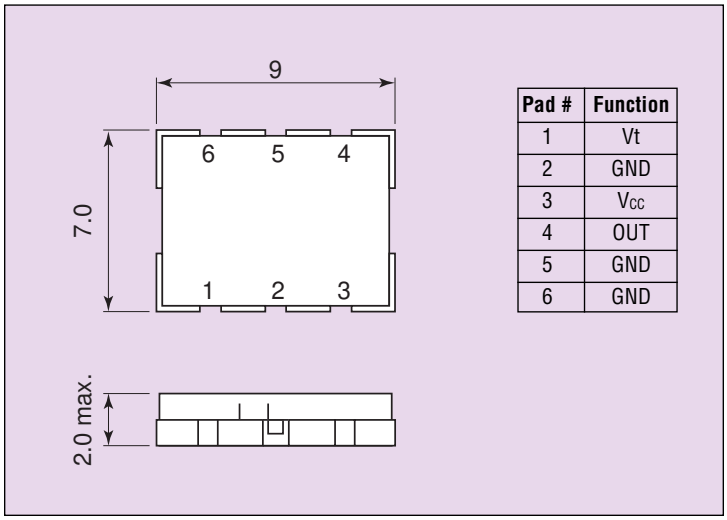


SPECIFICATIONS

Type		Frequency (MHz)	Part No.	Specifications (Ta=25°C)					
System	Module			V_{CC} (V)	I_{CC} (MA)	P_O (DBM)	F_{TU} (MHZ/V)	C/N (dBc)	T_{OP} (°C)
N-TACS	RX	765 ~ 800	EK-304R0783A1	3 ±0.2	9 max.	-1±3	23±3	65 min. (12.5kHz off BW 8kHz)	-20 ~ 70
PDC		1069~ 1090	EK-304R1080A1	2.2 ±0.2	6 max.	-3±3	25±3	70 min. (50kHz off BW21kHz)	-20~ 80
AMPS		914~939	EK-304R0927A9	2.55 ±0.05	12 max.	+3±2	14±2	108 min. (20kHz off)	-30~ 85
PCS		1310 ~ 1393	EK-304R1352A2	2.8 ±0.1	10 max.	-6 min.	39±4	100 min. (25kHz off)	-10 ~ 75
GSM		1006~ 1031	EK-304R1019A6				15±3		-20~ 75
PDC		780 ~ 841	EK-304R0811A1	2.2 ±0.2	8 max.	-1±3	46±7	67 min. (50kHz off 21kHz BW)	-30 ~ 85

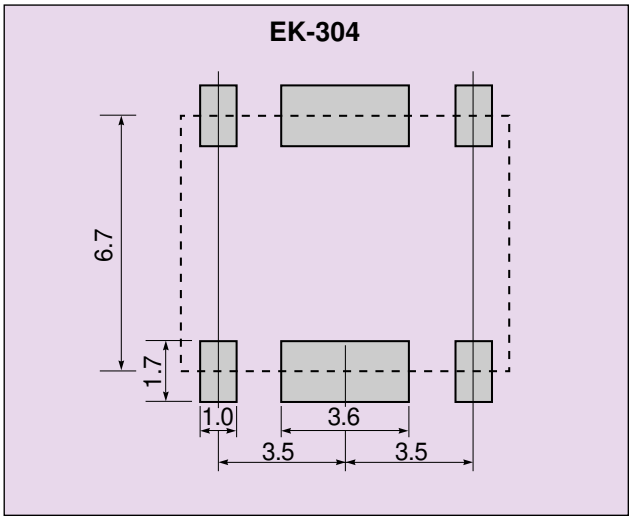
V_{CC}: Power supply, I_{CC}: Current consumption, P_O: Output level, F_{TU}: Tuning voltage sensitivity, T_{OP}: Operating temperature range

DIMENSIONS and PAD CONNECTION



Pad #	Function
1	Vt
2	GND
3	V_{CC}
4	OUT
5	GND
6	GND

RECOMMENDED LAND PATTERN



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Voltage Control Oscillator

YK Series - Surface Mount

f_o: 700 to 1600 MHz

FEATURES

1) SMD type
2) Covers 700~1600Mhz band
3) Small (7.8X6.0mm), Low Profile (2.00mm max.)
4) 2000 pieces per reel
5) Sold in increments of 2000 pieces

HOW TO ORDER

YK - 501 R 1171 A1 W

① ② ③ ④ ⑤ ⑥

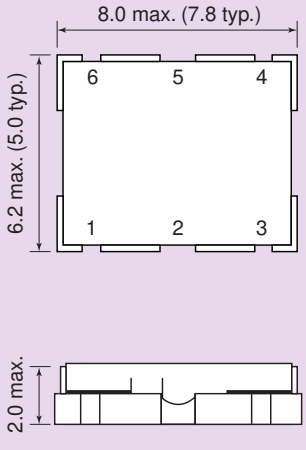
① Series: YK=700~1600MHz
② Dimensions
③ Applications: R=RX
④ Frequency: 1171=1171MHz
⑤ Individual specification
⑥ Packaging: W=Tape and reel

ELECTRICAL CHARACTERISTICS

Parameters	Specifications	Unit	Condition
Supply Voltage	2.6±0.1	V	—
Current Consumption	8.0	mA	Ta=25±5°C Vcc=2.5±0.05[V]
Frequency	1136 ~ 1206	MHz	Vt=0.3 ~ 2.4[V]
Output Level	-6	dBm	Ta=25±5°C Vcc=2.5±0.05[V]
Tuning Voltage Sensitivity	46±7	MHz/V	[f(2.4)-f(0.3)] /2.1
C/N (Phase Noise)	98	dBc/Hz	off set 25kHz 1Hz B.W.
PSU Stability	±1000	kHz	Vcc=2.6V ±0.1V
Temperature Stability	±3	MHz	-10 ~ 60°C ref 25°C
Pulling Stability	±1.5	MHz	VSWR=2 All Phase
Spurious Level	-10	dBc	Reference is fundamental
Operating Temp Range	-10 ~ 60	°C	—

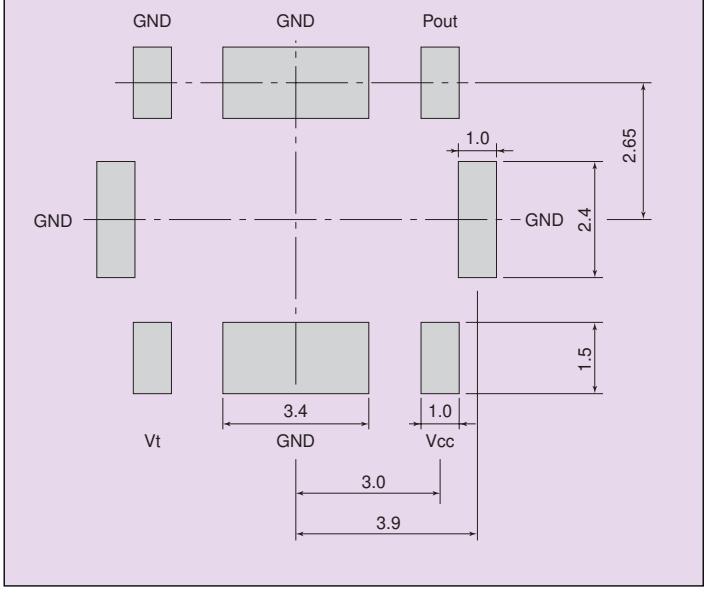
*Covering frequency range is between 700MHz ~ 1600MHz

DIMENSIONS and PAD CONNECTION



Pad #	Function
1	Vt
2	GND
3	Vcc
4	OUT
5	GND
6	GND

RECOMMENDED LAND PATTERN



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Voltage Control Oscillator

RK Series - Surface Mount

f_o: 1.3 to 2.0 GHz

FEATURES

1) Ultraminature size based on low temperature co-firable laminated substrate technology
2) Printed conductive line on inner layer contributes to ultra high density mounting
3) Reflow soldering available
4) 2000 pieces per reel
5) Sold in increments of 2000 pieces

HOW TO ORDER

RK - 405 R 1668 A1 W

① ② ③ ④ ⑤ ⑥

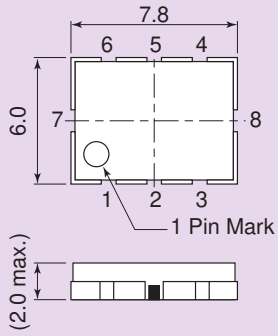
① Series: RK=1300~2000MHz
② Dimensions
③ Applications: R=RX
④ Frequency: 1668=1668Mhz
⑤ Individual specification
⑥ Packaging: W=Tape and reel

ELECTRICAL CHARACTERISTICS

Type		Frequency (MHz)	Part No.	Specifications (Ta=25°C)						
System	Module			Vcc (V)	Icc (mA)	Po (dBm)	ftu (MHz/V)	C/N Min	C/N Typ	Top (°C)
PHS	RX	1647 ~ 1669	RK-405R1658	3.0 ±0.15	6.5 max.	-1±3	24±5 Vt=0.5 ~ 2.5V	123 min (600kHz off)	128	-20°C ~ +60°C
PHS	RX	1651 ~ 1685	RK-405R1668	3.0 ±0.15	6.5 max.	-1±3	31±6 Vt=0.5 ~ 2.5V	123 min. (600kHz off)	127	-20°C ~ +60°C

Vcc: Power supply, Icc: current consumption, Po: Output level, ftu: tuning voltage sensivitiy, Top: Oeration temperature

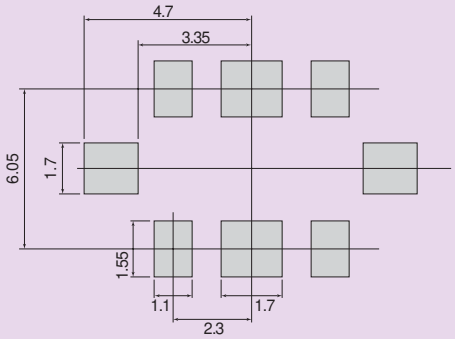
DIMENSIONS and PAD CONNECTION



1	Vt
2	GND
3	V_{DD}
4	OUT
5	GND
6	GND
7	GND
8	GND

Units:mm

RECOMMENDED LAND PATTERN



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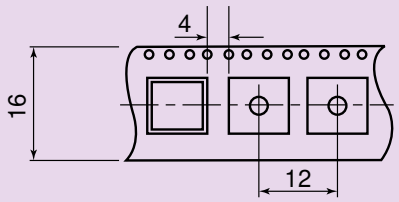
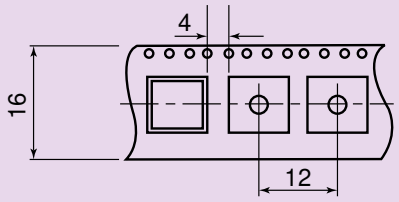
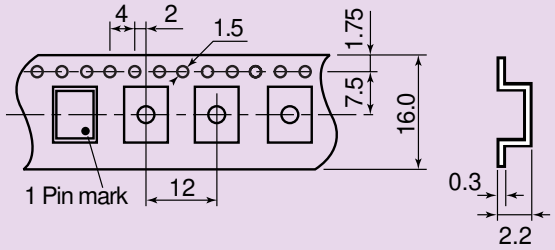
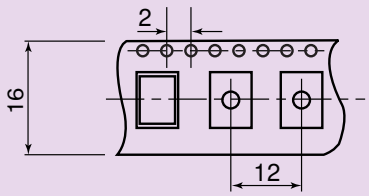
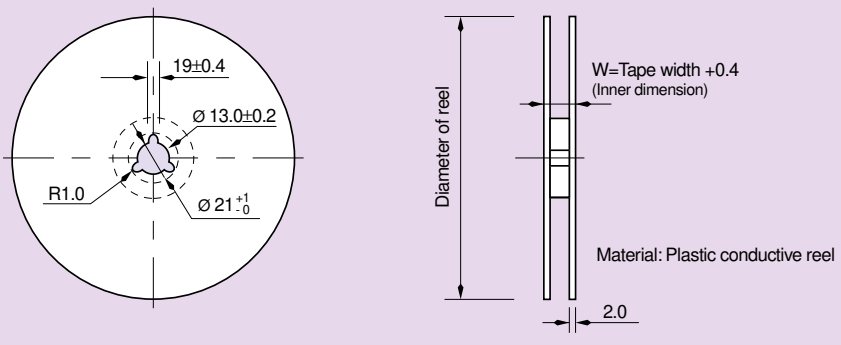
TAPE DIMENSIONS

Part No.	Specifications		
	Tape width, guide pitch	Diameter of Reel	Unit
VK-120		Ø 330	2000pcs
EK-304		Ø 330	2000pcs
YK-501		Ø 330	2000pcs
RK-405		Ø 330	2000pcs

REEL DIMENSIONS



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KXO-01 Series Crystal Clock Oscillators

TTL Drive - TTL Compatible

f_o: 8.0 to 50 MHz

FEATURES

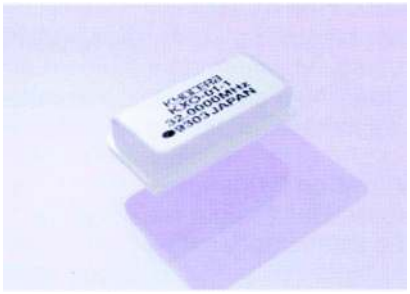
1) Lower Cost
2) 14 pin DIP compatible
3) Wide frequency range (8MHz - 50MHz)
4) All metal package minimizes RF radiation
5) Meets FCC EMI specifications
6) Solder coated pins
7) 25 pieces per tube
8) Sold in increments of 100 pieces

HOW TO ORDER

KXO-01 - 1 - 32.0000M T

① ② ③ ④

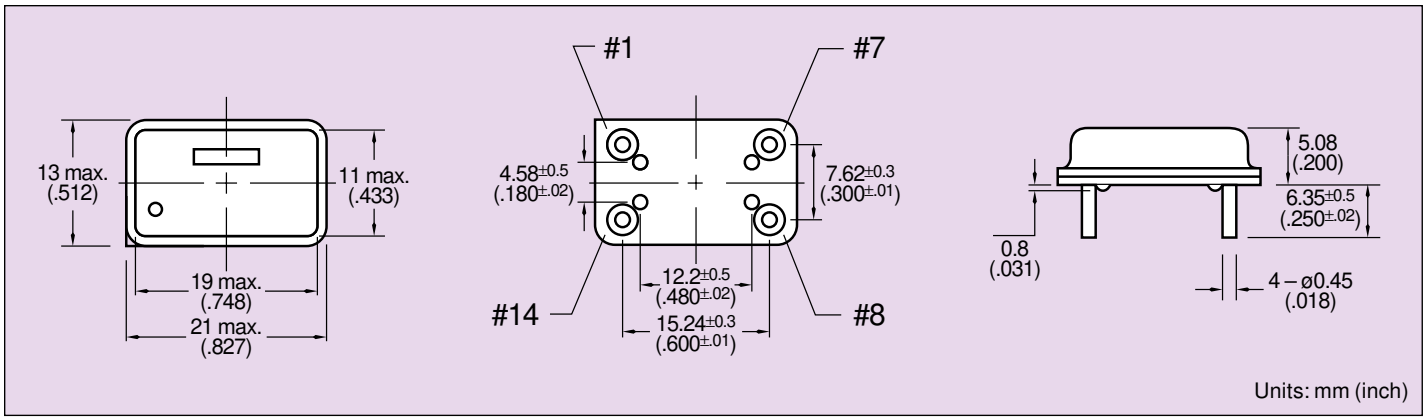
① Type: (Kyocera Crystal Oscillators)
② Frequency precision:
0 = ±50ppm (special)
1 = ±100ppm
③ Frequency
④ Packaging: T = Tube



SPECIFICATIONS (KXO-01)

Parameters		Code	Rating	Unit	Remarks
Output Frequency		f_{out}	8 to 50	MHz	
Frequency Precision		$\Delta f/f_o$	0:±50	ppm	0 to 70°C
			1±100	ppm	4.5V to 5.5V
Aging Rate		$\Delta f/f$	±5	ppm/y	
Operating Temperature Range		T_{opr}	0 to ±70	°C	
Storage Temperature Range			-55 to +125	°C	
Voltage		V_{DD}	5±0.5	VDC	
Electrical Current Consumption		I_{DD}	35 max	mA	
Output	Duty Ratio	S_y	40 to 60	%	1.4V DC level
	"0" Level	V_{OL}	0.4 max	V	At I_{OL}=16mA
	"1" Level	V_{OH}	2.4 min	V	At I_{OH}=400µA
	Rise and Fall Time	T_R, T_F	15 max	nsec	8 to 32MHz
			10 max	nsec	32.1 to 50MHz
Fan Out			1 to 10	TTL	

DIMENSIONS



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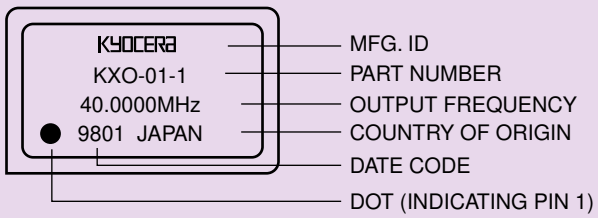
KXO-01 Series Crystal Clock Oscillators

TTL Drive - TTL Compatible

f_o: 8.0 to 50 MHz

MARKING



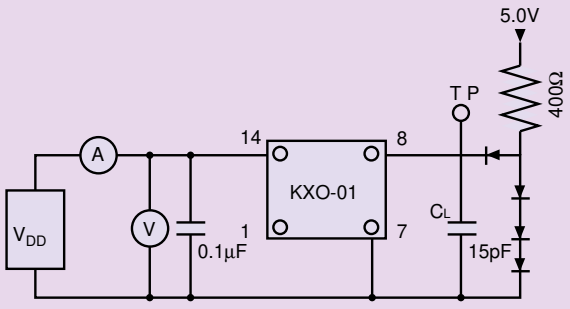
PIN CONNECTION

PIN #	FUNCTION
1	N.C.
7	Case/GND
8	Output
14	+5.0V D.C.

POPULAR FREQUENCY LIST

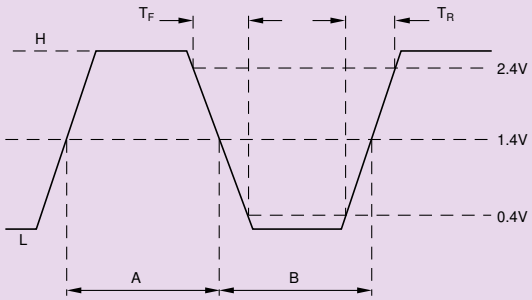
8.0000MHz	16.0000MHz	25.0000MHz
10.0000MHz	19.6608MHz	32.0000MHz
12.0000MHz	20.0000MHz	40.0000MHz
14.31818MHz	24.0000MHz	50.0000MHz

TEST CIRCUIT



CL=15pF max
(Inclusive of test jig and
probe capacitance)

SHAPE OF OUTPUT WAVE



Duty Ratio= $\frac{A}{A+B}$ X100

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KXO-HC/KHO-HC Series Crystal Clock Oscillators

HCMOS Drive - TTL or CMOS Compatible

f_o: 1 to 72 MHz

FEATURES

1) High speed CMOS clock oscillator
2) High power drive level
3) Low current consumption
4) Output available with TTL or CMOS compatibility
5) Enable/disable option
6) KHO-HC: 8 pin DIP
7) KXO-HC: 14 pin DIP
8) KXO: 25 pieces per tube
   KHO: 40 pieces per tube
9) KXO: Sold in increments of 100 pieces
   KHO: Sold in increments of 120 pieces

HOW TO ORDER

KXO-HC 1 -T S E - 32.0000M T

① ② ③ ④ ⑤ ⑥

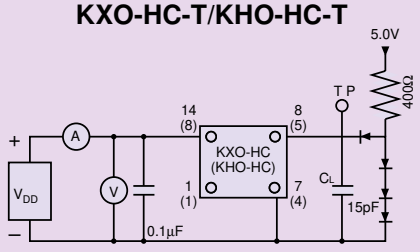
① Type: KXO = 14 pin DIP; KHO = 8 pin DIP
② Frequency precision:
S = ±25ppm, 0 = ±50ppm, 1 = ±100ppm
③ Output level/Duty cycle:
TS = TTL compatible/45 to 55%
CS = CMOS compatible/45 to 55%
④ Enable/Disable function:
☐ = without function, E = with function
⑤ Frequency
⑥ Packaging: T = Tube

SPECIFICATIONS: TTL COMPATIBLE (KXO-HC-T/KHO-HC-T)

Parameters		Code	Rating		Unit	Remarks
Output Frequency		f_{OUT}	1 to 50	>50	MHz	
Frequency Precision		f/f 0	S:±25 0:±50 1:±100	S:±25 0:±50 1:±100	ppm ppm ppm	0 to 70°C 4.5V to 5.5V
Operating Temperature Range		T_{OPR}	0 to +70	0 to +70	°C	
Storage Temperature		T_{str}	-55~+125	-55~+125	°C	
Voltage		V_{DD}	5±0.5	5±0.25	V	
Electrical Current Consumption		I_{DD}	50 max	70 max	mA	f=50MHz, C_L=15pF (10TTL load)
Output	Duty Cycle	S_Y	45 to 55	45 to 55	%	1.4V DC level
	"0" Level	V_{OL}	0.4 max	0.4 max	V	At I_{OL}=16mA
	"1" Level	V_{OH}	2.4 min	2.4 min	V	At I_{OH}=-1mA
	Rise and Fall Time	T_R, T_F	5.0 max	3.5 max	nsec	0.4V to 2.4V, C_L=15pF (10TTL load)
Fan Out			TTL 10 gates	TTL 10 gates		CMOS level OK
Time to Enable/Disable			100 max	100 max	nsec	Tristate output
Input Current		I_{IH} I_{IL}	10 max -150 max	10 max -150 max	µA µA	
Input Voltage		V_{IH} V_{IL}	2.2 min 0.8 max	2.2 min 0.8 max	V V	
Aging		f/f	±5	±5	ppm/yr	

TEST CIRCUIT

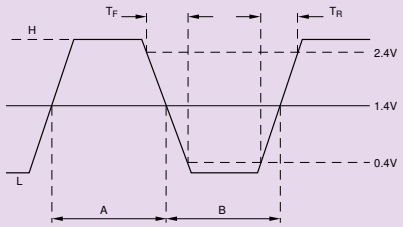
KXO-HC-T/KHO-HC-T



CL=15pF max
(Inclusive of test jig and probe capacitance)

SHAPE OF OUTPUT WAVE

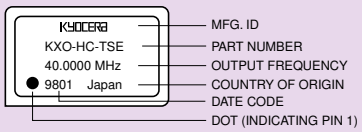
KXO-HC-T/KHO-HC-T



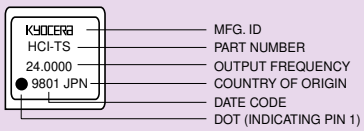
Duty Ratio= $\frac{A}{A+B}$ X 100

MARKINGS

KXO-HC



KHO-HC



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KXO-HC/KHO-HC Series Crystal Clock Oscillators

HCMOS Drive - TTL or CMOS Compatible

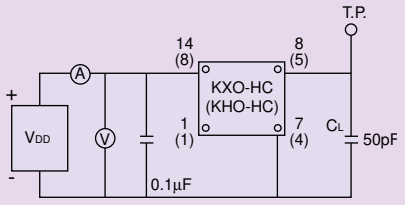
f_o: 1 to 72 MHz

SPECIFICATIONS: CMOS COMPATIBLE (KXO-HC-C/KHO-HC-C)

Parameters		Code	Rating		Unit	Remarks
Output Frequency		f_{OUT}	1 to 50	>50	MHz	
Frequency Precision		f/f $_0$	S:±25 0:±50 1:±100	S:±25 0:±50 1:±100	ppm ppm ppm	0 to 70°C 4.5V to 5.5V
Operating Temperature Range		T_{OPR}	0 to +70	0 to +70	°C	
Storage Temperature Range		T_{str}	-55~+125	-55~+125	°C	
Voltage		V_{DD}	5±0.5	5±0.25	V	
Electrical Current Consumption		I_{DD}	50 max	80 max	mA	f=>50MHz, C_L=15pF f=<50MHz, C_L=50pF
Output	Duty Cycle	S_Y	45 to 55	45 to 55	%	1/2V_{DD} level
	"0" Level	V_{OL}	0.1 V_{DD} max	0.1 V_{DD} max	V	At I_{OL}=16mA
	"1" Level	V_{OH}	0.9 V_{DD} min	0.9 V_{DD} min	V	At I_{OH}=-1mA
	Rise and Fall Time	T_R, T_F	10 max	6 max	nsec	10% V_{DD} to 90% V_{DD} C_L=50pF
Time to Enable Disable			100 max	100 max	nsec	Tristate Output
Input Current		I_{IH} I_{IL}	10 max -150 max	10 max -150 max	µA µA	
Input Voltage		V_{IH} V_{IL}	2.2 min 0.8 max	2.2 min 0.8 max	V V	
Aging		f/f	±5	±5	ppm/yr	

TEST CIRCUIT

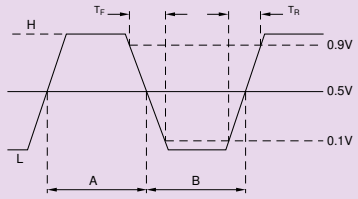
(KXO-HC-C/KHO-HC-C)



CL=50pF max
(Inclusive of test jig and probe capacitance)

SHAPE OF OUTPUT WAVE

(KXO-HC-C/KHO-HC-C)



Duty Ratio= $\frac{A}{A+B}$ X 100

PIN CONNECTION

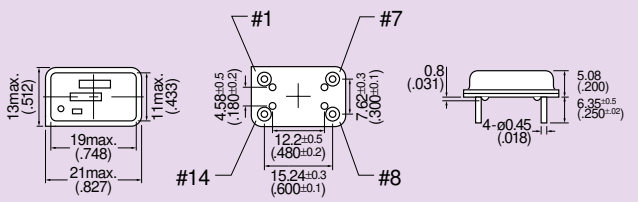
KXO	KHO	
1	1	N.C. or Control
7	4	Case /GND
8	5	Output
14	8	+5.0V D.C.

ENABLE/DISABLE FUNCTION CHART

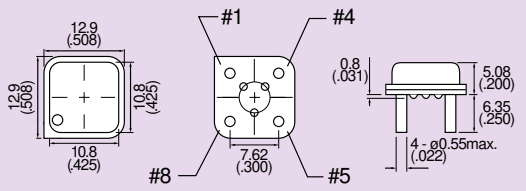
Pin 1	Pin 8
High or Open	Oscillation
Low	High Impedance

DIMENSIONS

KXO-HC



KHO-HC



Unit: mm (inch)

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386 Series Clock Oscillators

HCMOS Drive - CMOS Compatible

f_o: 24, 32, 40, 50 MHz

FEATURES

1) Capable of driving the 80386 and surrounding LSI directly up to 150pF load
2) Replaces existing clock genarator and/or buffer
3) 45/55 symmetry for all standard frequencies even at 150pF load
4) Enable/disable function as standard
5) 25 pieces per tube
6) Sold in increments of 100 pieces

HOW TO ORDER

386-HC 1 - C S E - 40.0000M T

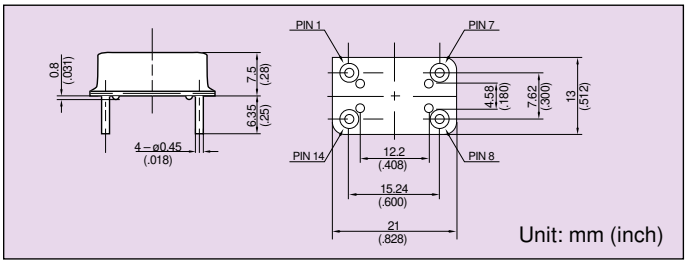
① ② ③ ④ ⑤ ⑥

① Type: 386 = 14 pin DIP
② Frequency precision: 1 = ±100ppm
③ Output level/Duty cycle
CS = CMOS compatible/45 to 55%
④ Enable/disable function:
☐ = without function, E = with function
⑤ Frequency
⑥ Packaging: T = Tube

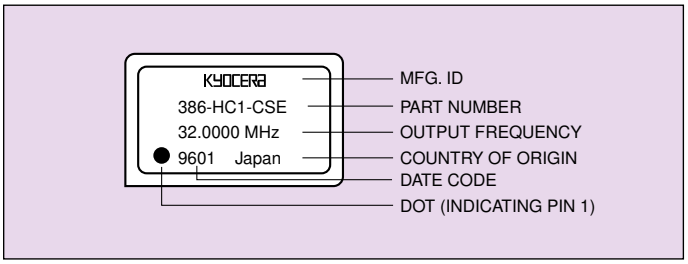
SPECIFICATIONS (386-HC)

Parameters		Code	Rating	Unit	Remarks
Output Frequency		f_{OUT}	24, 32, 40 50	MHz MHz	CL=150pFmax CL=80pFmax
Frequency Precision (Inclusive of Temp. Voltage variation)		Δf/f	1:±100	ppm	Ta=0~70°C
Aging Rate		Δf/f	±5	ppm/yr	
Operating Temperature		T_{OPR}	0~+70	°C	
Storage Temperature Range		T_{STR}	-55~+125	°C	
Supply Voltage		V_{DD}	5±0.25	V	
Supply Current		I_{CC}	65 max	mA	Cl=150pF, Ta=25°C
Output	**Duty Ratio**	Sy	45~55	%	1/2 V_{DD} level
	"0" Level	V_{OL}	0.1V_{DD} max	V	I_{OL}=12mA
	"1" Level	V_{OH}	0.9V_{DD} min	V	I_{OL}=-1mA
	Rise and Fall Time	T_R, T_F	See Clock Time Table	nsec	
Enable/Disable Time			100 max 100 max	nsec nsec	Type E Tristate Output
Input	**Current**	I_{IH} I_{IL}	10 max -150 max	μA μA	V_{DD}= 5.25V V_{DD}=5.25V
	Voltage	V_{IH} V_{IL}	2.2 min 0.8 max	V V	
Fan Out			7	TTL	
Load Capacitance		C_L	150 80	pF pF	f=12.0MHz~40MHz f=40.1MHz~50MHz

DIMENSIONS



MARKINGS



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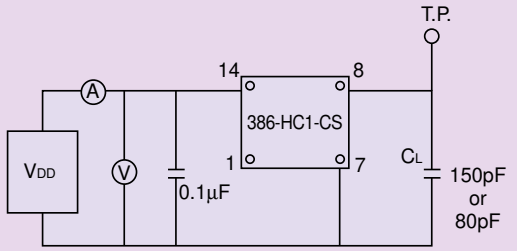
386 Series Clock Oscillators

HCMOS Drive - CMOS Compatible

f_o: 24, 32, 40, 50 MHz

TEST CIRCUIT



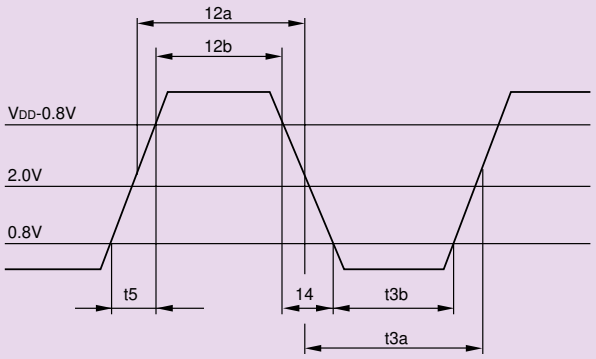
CL: 150pF max (Inclusive of test JIG and probe capacitance)

PIN CONNECTION

386	Function
1	N.C. or Control
7	Case GND
8	Output
14	V_{DD}

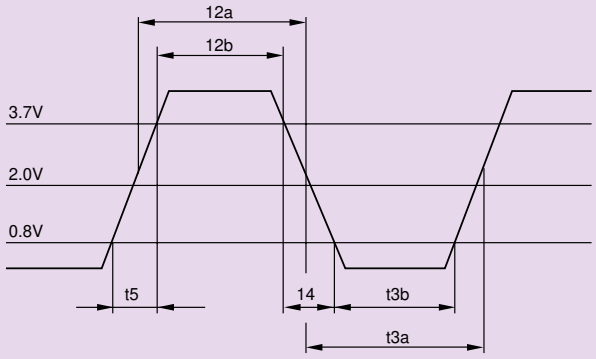
CLOCK TIME TABLE (32MHz, 40MHz)

Frequency	32MHz		40MHz	
Clock time (ns)	Min	Max	Min	Max
Clock high time t2a	9	-	8	-
Clock high time t2b	5	-	5	-
Clock low time t3a	9	-	8	-
Clock low time t3b	7	-	6	-
Clock tall time t4	-	7.5	-	8
Clock tall time t5	-	7.5	-	8



CLOCK TIME TABLE (50MHz)

Frequency	50MHz	
Clock time(ns)	Min	Max
Clock high time t2a	7	-
Clock high time t2b	4	-
Clock low time t3a	7	-
Clock low time t3b	5	-
Clock tall time t4	-	7
Clock tall time t5	-	7



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Corporate Offices
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FAX: 843-448-1943

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FAX: 360-699-8751

AVX North Central, IN
Tel: 317-848-7153
FAX: 317-844-9314

AVX Northeast, MA
Tel: 508-485-8114
FAX: 508-485-8471

AVX Mid-Pacific, CA
Tel: 408-436-5400
FAX: 408-437-1500

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Tel: 602-834-7919
FAX: 602-834-8078

AVX South Central, TX
Tel: 972-669-1223
FAX: 972-669-2090

AVX Southeast, NC
Tel: 919-878-6357
FAX: 919-878-6462

AVX Canada
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AP-TD30M398-C

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