

Low Frequency Quartz Crystals from Micro Crystal are the simple solution to sourcing crystals compatible with TI's MSP430 Ultra Low Power Microcontrollers!



Take full advantage of the capabilities of TI's MSP430. Add a 32.768 kHz crystal to your MSP430 controller and you'll generate an accurate reference frequency for the microcontroller's sleep mode, as well as your other circuitry that may require a timing reference.

We can help you match the right crystal and you'll have a reliable and accurate timing source.

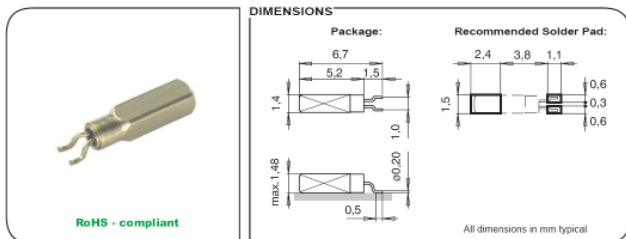
Micro Crystal has worked with TI to help you choose an ideal crystal for your circuit application. Tell us about your application and we will provide recommendations for a crystal that is known to function well in your application.

The Micro Crystal line includes timing crystals in a variety of sizes and package designs to meet a wide range of size and cost constraints. We can offer application engineering assistance to help you optimize the efficiency of your sleep mode circuitry, as well as selection advice. Fast delivery is available on 32.768 kHz crystals in virtually any quantity required.



### MS3V-T1R

Tuning Fork Crystal 30 kHz – 200 kHz



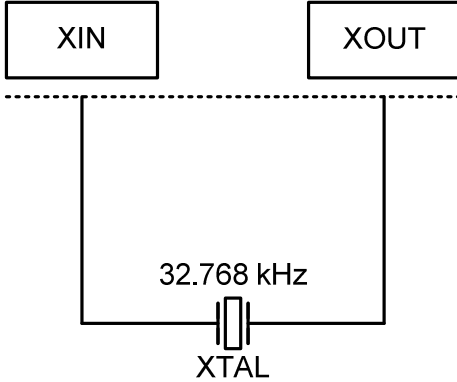
Contact: [sales@microcrystal.com](mailto:sales@microcrystal.com)

Micro Crystal is one of the world's leading producers of subminiature timing crystals. Founded in 1978 by the Swiss watch industry, Micro Crystal is still a company of The Swatch Group.

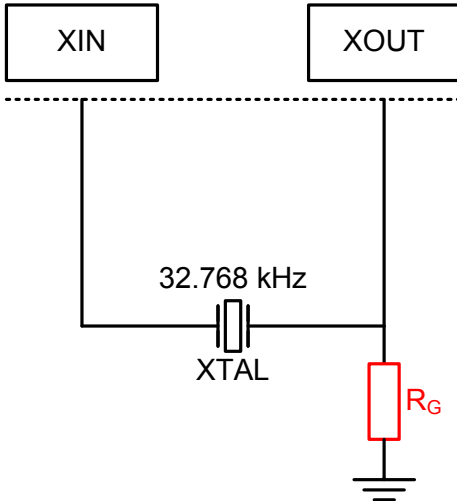
Complete Datasheets in PDF format are available at: [www.microcrystal.com](http://www.microcrystal.com)

In accordance with our policy of continuous development and improvement, Micro Crystal reserves the right to modify specifications or design-recommendations without prior notice. The recommendations stated above are based on measured-results, respecting the "oscillator design rules". Micro Crystal makes no representation or warranty for information in this "Crystal Recommendations".

### MSP430x1xx & x3xx Families



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### Oscillator Design Check

Test Conditions		
Power Supply Voltage $V_{DD}$	$\geq 3.0$	V
Load Capacitors	Integrated	pF
Results		
Effective Load Capacitance	10.2	pF
Oscillation Allowance	300	k $\Omega$
Oscillator Output Voltage AC	400	mV <sub>RMS</sub>
Drive Level	0.220	$\mu$ W
Startup Time	1000	ms
Overtone Mode Suppression	Safe	----

### Oscillator Design Check

Test Conditions		
Power Supply Voltage $V_{DD}$	<b>&lt;3.0</b>	V
Load Capacitors	Integrated	pF
$R_G$	<b>5.1</b>	<b>M<math>\Omega</math></b>
Results		
Effective Load Capacitance	10.2	pF
Oscillation Allowance	300	k $\Omega$
Oscillator Output Voltage AC	350	mV <sub>RMS</sub>
Drive Level	0.220	$\mu$ W
Startup Time	1000	ms
Overtone Mode Suppression	Safe	----

### Recommendation

Crystal		
Crystal Type	MS3V-T1R / CC7V-T1A	
Frequency	32.768	kHz
Load Capacitance $C_L$	9.0 or 12.5	pF
Tolerance	+/-20	ppm

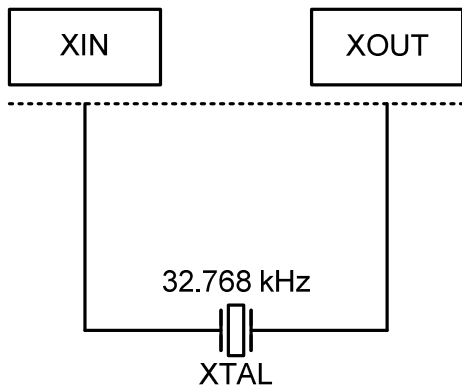
### Remarks

If  $V_{DD} < 3.0$  V, the 5.1 M $\Omega$  ( $R_G$ ) option allows the use of SMD quartz crystals with an ESR up to 60 k $\Omega$  typ.

Please find detailed information about MS3V-T1R, CC7V-T1A and all others crystal types at [www.microcrystal.com](http://www.microcrystal.com).

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### MSP430x4xx Family



### Oscillator Design Check

Test Conditions		
Power Supply Voltage $V_{DD}$	$\geq 1.8$	V
Load Capacitors	Integrated	pF
Oscillator Setting $C_X$	18	pF
Results		
Effective Load Capacitance	9.0	pF
Oscillation Allowance	500	$k\Omega$
Oscillator Output Voltage AC	130	$mV_{RMS}$
Drive Level	0.070	$\mu W$
Startup Time	400	ms
Overtone Mode Suppression	Safe	----

### Recommendation

Crystal		
Crystal Type	MS3V-T1R / CC7V-T1A	
Frequency	32.768	kHz
Load Capacitance $C_L$	7.0 or 9.0	pF
Tolerance	$\pm 20$	ppm
Oscillator Settings		
Oscillator Setting	$C_X$	0 10 <b>14</b> <b>18</b> pF
OSCCAPx		0 1 <b>2</b> <b>3</b> ----
Load Capacitance	$C_L$	4.0 5.8 <b>7.0</b> <b>9.0</b> pF

### Remarks

**Recommended setting:**  $C_X = 18$  pF (OSCCAPx = 3) Corresponding crystal's  $C_L$ : 9.0 pF.

**Alternative setting:**  $C_X = 14$  pF (OSCCAPx = 2) Corresponding crystal's  $C_L$ : 7.0 pF.

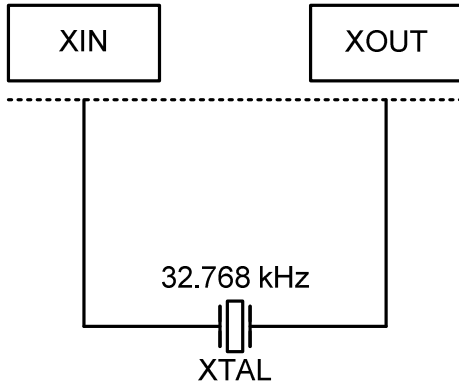
The  $C_X$ : 0 pF and 10 pF settings are not recommended to use with quartz crystals.

$C_X$  corresponds to parameter  $C_{XIN}$  and  $C_{XOUT}$  (Integrated Load Capacitance),  $C_{XIN} = C_{XOUT}$ .

Please find detailed information about MS3V-T1R, CC7V-T1A and all others crystal types at [www.microcrystal.com](http://www.microcrystal.com).

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## MSP430x2xx Family



## Oscillator Design Check

Test Conditions		
Power Supply Voltage $V_{DD}$	$\geq 1.8$	V
Load Capacitors	Integrated	pF
Oscillator Setting $C_x$	8.5	pF
Results		
Effective Load Capacitance	12.2	pF
Oscillation Allowance	500	$k\Omega$
Oscillator Output Voltage AC	90	$mV_{RMS}$
Drive Level	0.030	$\mu W$
Startup Time	450	ms
Overtone Mode Suppression	Safe	----

## Recommendation

Crystal	
Crystal Type	MS3V-T1R / CC7V-T1A
Frequency	32.768 kHz
Load Capacitance $C_L$	9.0 or 12.5 pF
Tolerance	+/-20 ppm
Oscillator Settings	
Oscillator Setting	$C_x$ 1 <b>5.5</b> <b>8.5</b> 11 pF
XCAPx	0 <b>1</b> <b>2</b> 3 ----
Load Capacitance	$C_L$ 5.0 <b>9.0</b> <b>12.5</b> 14.5 pF

## Remarks

**Recommended setting:**  $C_x = 8.5$  pF (XCAPx = 2) **Corresponding crystal's  $C_L$ : 12.5 pF.**

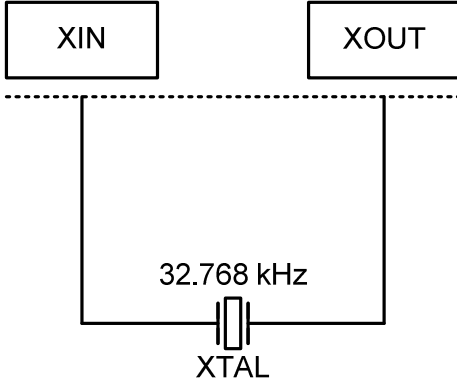
**Alternative setting:**  $C_x = 5.5$  pF (XCAPx = 1) **Corresponding crystal's  $C_L$ : 9.0 pF.**

The  $C_x$ : 1 pF and 11 pF settings are not recommended to use with quartz crystals.

$C_x$  corresponds to parameter  $C_{L,eff}$  (Integrated Effective Load Capacitance, LF mode).

Please find detailed information about MS3V-T1R, CC7V-T1A and all others crystal types at [www.microcrystal.com](http://www.microcrystal.com).

## MSP430x5xx Family



## Oscillator Design Check

Test Conditions		
Power Supply Voltage $V_{DD}$	$\geq 1.8$	V
Load Capacitors	Integrated	pF
Oscillator Setting XTS	3	----
Oscillator Setting XCAPx	3	----
Results		
Effective Load Capacitance	12.5	pF
Oscillation Allowance	$>500$	$k\Omega$
Oscillator Output Voltage AC	90	$mV_{RMS}$
Drive Level	0.010	$\mu W$
Startup Time	200	ms
Overtone Mode Suppression	Safe	----

## Recommendation

Crystal		
Crystal Type	MS3V-T1R / CC7V-T1A	
Frequency	32.768	kHz
Load Capacitance $C_L$	7.0 or 12.5	pF
Tolerance	$\pm 20$	ppm

## Oscillator Settings

	XCAPx	XTS				Effective Load Capacitance $C_{Load} / pF$	Crystal Load Capacitance $C_L / pF$
		0	1	2	3		
	0				4.3	To be used with external load capacitors	
	1	✓			7.5	7.0 pF	
	2				10.3	Does not correspond to a standard $C_L$ value	
	3			✓	12.5	12.5 pF	

## Remarks

**Recommended setting:** XTS = 3 / XCAPx = 3 Corresponding crystal's  $C_L$ : 12.5 pF.

**Lowest power consumption setting:** XTS = 0 / XCAPx = 1 Corresponding crystal's  $C_L$ : 7.0 pF.

XTS: oscillator's drive setting, 0 = min to 3 = max.

XCAPx: integrated load capacitors  $C_{XIN}$  and  $C_{XOUT}$  (represented by  $C_{L,eff}$ ) setting, 0 = 2 pF, 1 = 5.5 pF, 2 = 8.5 pF and 3 = 12.0 pF.

Please find detailed information about MS3V-T1R, CC7V-T1A and all others crystal types at [www.microcrystal.com](http://www.microcrystal.com).