MICRO CRYSTAL SWITZERLAND

Crystal Recommendations

For TI MSP430 Microcontrollers

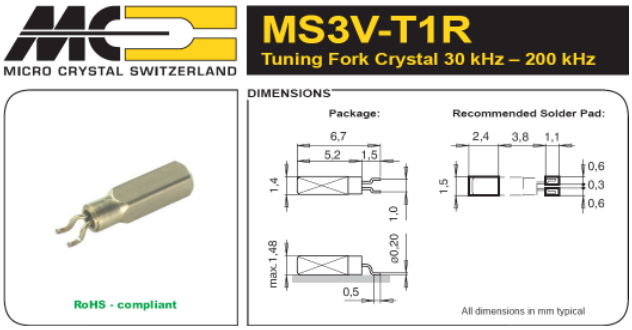
Low Frequency Quartz Crystals from Micro Crystal are the simple solution to sourcing crystals compatible with TI's MSP430 Ultra Low Power Microcontrollers!

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.



Contact: 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

Headquarters: Micro Crystal AG
Mühlestrasse 14
CH-2540 Grenchen
Switzerland

Tel. +41 32 655 82 82
Fax +41 32 655 82 83
Internet www.microcrystal.com
Email sales@microcrystal.com

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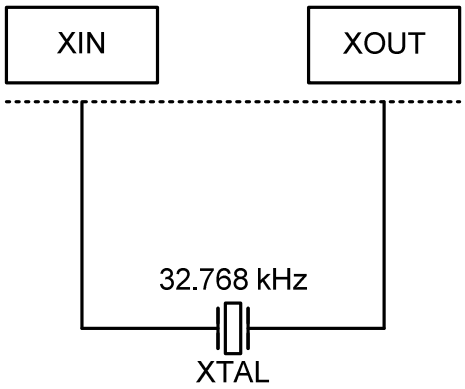
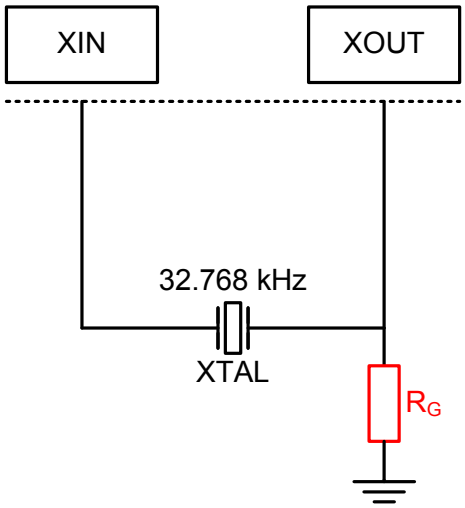
Crystal Recommendations

TI MSP430 x1xx & x3xx Families

MSP430x1xx & x3xx Families



MSP430x1xx & x3xx Families



Oscillator Design Check

Test Conditions		
Power Supply Voltage V_{DD}	≥3.0	V
Load Capacitors	Integrated	pF
Results		
Effective Load Capacitance	10.2	pF
Oscillation Allowance	300	kΩ
Oscillator Output Voltage AC	400	mV_{RMS}
Drive Level	0.220	µW
Startup Time	1000	ms
Overtone Mode Suppression	Safe	----

Oscillator Design Check

Test Conditions		
Power Supply Voltage V_{DD}	**<3.0**	V
Load Capacitors	Integrated	pF
R_G	**5.1**	**MΩ**
Results		
Effective Load Capacitance	10.2	pF
Oscillation Allowance	300	kΩ
Oscillator Output Voltage AC	350	mV_{RMS}
Drive Level	0.220	µW
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 MΩ (R_G) option allows the use of SMD quartz crystals with an ESR up to 60 kΩ typ.

Please find detailed information about MS3V-T1R, CC7V-T1A and all others crystal types at www.microcrystal.com.

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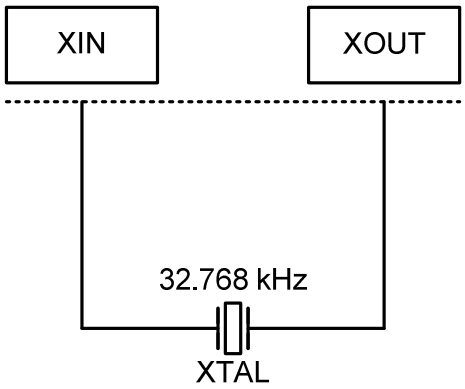
Crystal Recommendations

TI MSP430 x4xx Family

MSP430x4xx Family



Oscillator Design Check		
Test Conditions		
Power Supply Voltage V_{DD}	≥1.8	V
Load Capacitors	Integrated	pF
Oscillator Setting C_X	18	pF
Results		
Effective Load Capacitance	9.0	pF
Oscillation Allowance	500	kΩ
Oscillator Output Voltage AC	130	mV_{RMS}
Drive Level	0.070	µW
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		+/-20				ppm
Oscillator Settings						
Oscillator Setting	C_X	0	10	14	18	pF
OSCCAPx		0	1	2	3	----
Load Capacitance	C_L	4.0	5.8	7.0	9.0	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.

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CH-2540 Grenchen
Switzerland

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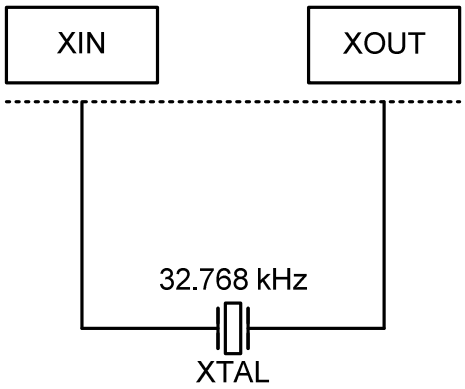
Crystal Recommendations

TI MSP430 x2xx Family

MSP430x2xx Family



Oscillator Design Check		
Test Conditions		
Power Supply Voltage V_{DD}	≥1.8	V
Load Capacitors	Integrated	pF
Oscillator Setting C_X	8.5	pF
Results		
Effective Load Capacitance	12.2	pF
Oscillation Allowance	500	kΩ
Oscillator Output Voltage AC	90	mV_{RMS}
Drive Level	0.030	µW
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	5.5	8.5	11	pF
XCAPx		0	1	2	3	----
Load Capacitance	C_L	5.0	9.0	12.5	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.

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CH-2540 Grenchen
Switzerland

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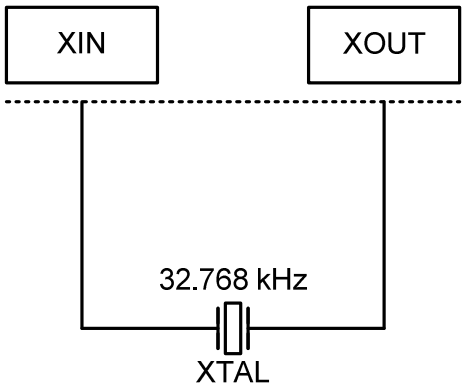
Crystal Recommendations

TI MSP430 x5xx Family

MSP430x5xx Family



Oscillator Design Check

Test Conditions		
Power Supply Voltage V_{DD}	≥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	kΩ
Oscillator Output Voltage AC	90	mV_{RMS}
Drive Level	0.010	µW
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	+/-20	ppm

Oscillator Settings

		XTS				Effective Load Capacitance	Crystal Load Capacitance
		0	1	2	3	C_{Load} / pF	C_L / pF
XCAPx	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.

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Headquarters: Micro Crystal AG
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CH-2540 Grenchen
Switzerland

Tel. +41 32 655 82 82
Fax +41 32 655 82 83
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