MICRO CRYSTAL SWITZERLAND

Crystal Recommendations

For TI MSP430 Microcontrollers

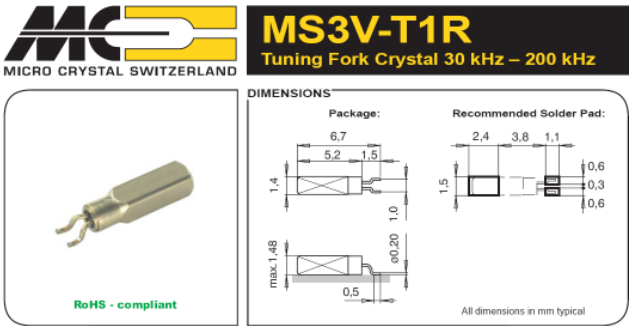
Low Frequency Quartz Crystals from Micro Crystal are the simple solution to sourcing crystals compatible with TI's MSP430 Ultra Low Power Microcontrollers!

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.ch

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.ch

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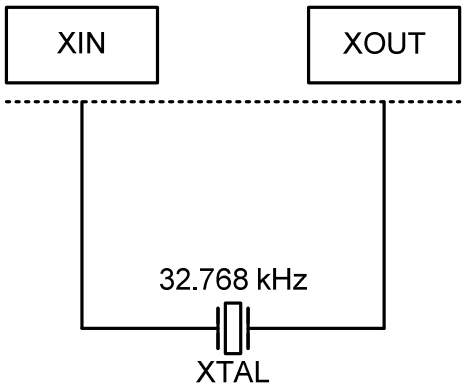
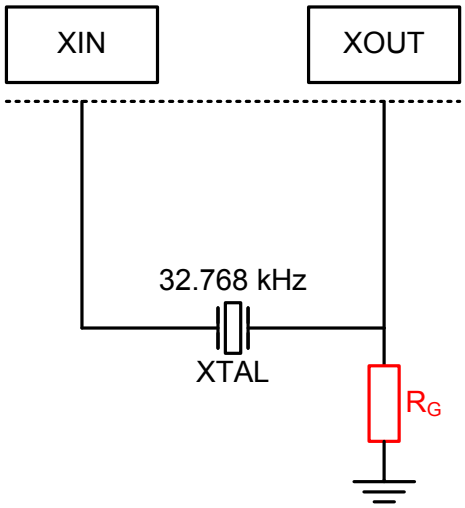
Crystal Recommendations

TI MSP430 x1xx & x3xx Families

MSP430x1xx & x3xx Families



MSP430x1xx & x3xx Families



Oscillator Performances 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 Performances 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	----

Crystal Recommendation

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

Remarks

- All load capacitors are integrated.
- The 32.768 kHz crystal must be connected to XIN and XOUT pins and the crystal's ESR constraints have to be respected.
- The PCB traces should be designed as short as possible to avoid additional load capacitance and to minimize external interferences.
- **If V_{DD} is <3.0 V, the 5.1 MΩ (R_G) option allows the use of SMD crystals with an ESR up to 60 kΩ typ.**

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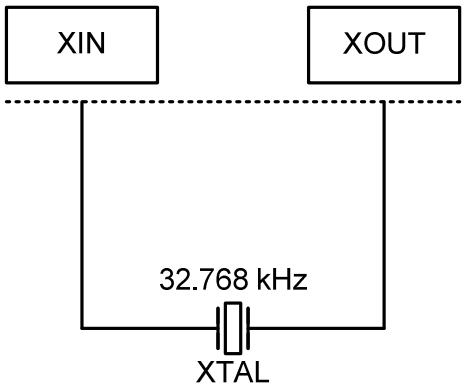
Crystal Recommendations

TI MSP430 x4xx Family

MSP430x4xx Family



Oscillator Performances Check

Test Conditions		
Power Supply Voltage V_{DD}	≥1.8	V
Load Capacitors	Integrated	pF
Oscillator Setting C_X[1]	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	----

Crystal Recommendation

Crystal Type Metal-can		MS3V-T1R				
Crystal Type Ceramic		CC7V-T1A				
Frequency		32.768				kHz
Tolerance		+/-20				ppm
Oscillator Setting	C_X[1]	0	10	14	18	pF
OSCCAPx		0	1	2	3	----
Load Capacitance	C_L	4.0	5.8	7.0	9.0	pF

[1] C_X corresponds to parameters C_{XIN} and C_{XOUT} (Integrated Load Capacitance), $C_{XIN} = C_{XOUT}$.

Recommendations

- **Recommended "Oscillator Setting":** **$C_{XIN} = C_{XOUT} = 18$ pF** **Corresponding crystal's C_L: 9.0 pF.**
- **Alternative "Oscillator Setting":** **$C_{XIN} = C_{XOUT} = 14$ pF** **Corresponding crystal's C_L: 7.0 pF.**
- The 0 pF and 10 pF settings are not recommended to use with a quartz crystal.

Remarks

- All load capacitors C_{XIN} and C_{XOUT} are integrated and selectable (Oscillator Setting).
- The 32.768 kHz crystal must be connected to XIN and XOUT pins and the crystal's ESR constraints have to be respected.
- The PCB traces should be designed as short as possible to avoid additional load capacitance and to minimize external interferences.

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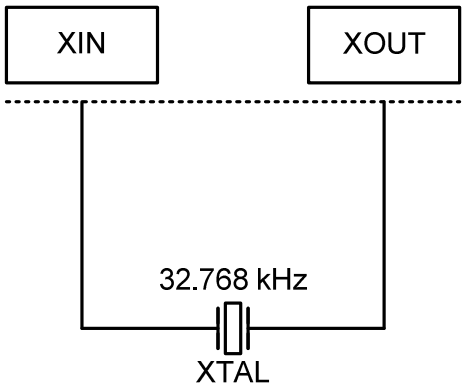
Crystal Recommendations

TI MSP430 x2xx Family

MSP430x2xx Family



Oscillator Performances Check		
Test Conditions		
Power Supply Voltage V_{DD}	≥1.8	V
Load Capacitors	Integrated	pF
Oscillator Setting C_X[1]	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	----

Crystal Recommendation						
Crystal Type Metal-can			MS3V-T1R			
Crystal Type Ceramic			CC7V-T1A			
Frequency			32.768			kHz
Tolerance			+/-20			ppm
Oscillator Setting	C_X[1]	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

[1] C_X corresponds to parameter $C_{L,eff}$ (Integrated Effective Load Capacitance, LF mode).

Recommendations

- **Recommended "Oscillator Setting": $C_{L,eff}$ = 8.5 pF Corresponding crystal's C_L: 12.5 pF.**
- **Alternative "Oscillator Setting": $C_{L,eff}$ = 5.5 pF Corresponding crystal's C_L: 9.0 pF.**
- The 1 pF and 11 pF settings are not recommended to use with a quartz crystal.

Remarks

- All load capacitors C_{XIN} and C_{XOUT} (represented by $C_{L,eff}$) are integrated and selectable (Oscillator Setting).
- The 32.768 kHz crystal must be connected to XIN and XOUT pins and the crystal's ESR constraints have to be respected.
- The PCB traces should be designed as short as possible to avoid additional load capacitance and to minimize external interferences.

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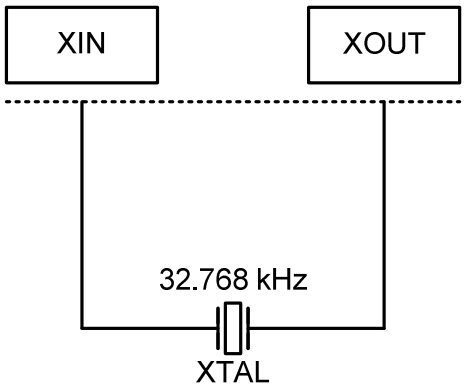
Crystal Recommendations

TI MSP430 x5xx Family

MSP430x5xx Family



Oscillator Performances 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	----

Crystal Recommendation

Crystal Type Metal-can		MS3V-T1R	
Crystal Type Ceramic		CC7V-T1A	
Frequency		32.768	kHz
Tolerance		+/-20	ppm
Load Capacitance	C_L	7.0 or 12.5	pF

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	✓[1]				7.5	7.0 pF
	2					10.3	Does not correspond to a standard C_L value
	3				✓[2]	12.5	12.5 pF

[1] Lowest power consumption oscillator setting. [2] Recommended oscillator setting.

Remarks

- 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.
- The 32.768 kHz crystal must be connected to XIN and XOUT pins and the crystal's ESR constraints have to be respected.
- The PCB traces should be designed as short as possible to avoid additional load capacitance and to minimize external interferences.

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