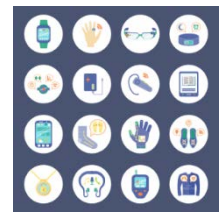


# Capacitive touch for smart wearables using ultra-low-power MSP430™ microcontrollers with CapTIvate™ technology



Features	Benefits	Applications
2.29-mm x 2.34-mm die-size ball grid array (DSBGA)	Enables tiny sensors	Smart wearables with tight space limitations
< 5 $\mu$ A average current – industry's lowest-power capacitive touch solution	Extends battery life and enables wake-on-touch capability	Smart watches with displays
Proximity sensing up to 15-cm distance	Enables wake-on-proximity capability	Smart glasses
Support for metal and plastic overlay	Allows flexibility in end equipment design	Touch surfaces for waterproof devices

Wearables with smart electronics and capacitive touch controls are becoming more popular. The shrinking form factors of wearables require designers to provide these capabilities in small semiconductor packages to fit on tiny circuit boards.

While these smart wearables have a great potential to improve quality of life and appeal, they bring up new challenges including those related to battery power management as well as environmental conditions of humidity, dirt and temperature changes.

MSP430™ microcontrollers (MCUs) with integrated CapTIvate™ technology provide capacitive touch and proximity detection capabilities while drawing less than 5  $\mu$ A. For example, a smart watch can be placed in an ultra-low power consumption state until a person actually puts it on.

MSP430 MCUs with CapTIvate technology are fully programmable with up to 16 KB of Ferroelectric RAM (FRAM) as non-volatile memory. FRAM supports virtually unlimited write endurance, enabling data logging capabilities, which are critical to smart watches and smart glasses.

Learn more at [www.ti.com/CapTIvate](http://www.ti.com/CapTIvate)

## Get started with CapTIvate technology for smart wearables

MSP430 MCUs with CapTIvate technology	<a href="#">MSP430FR2633</a> , <a href="#">MSP430FR2632</a> , <a href="#">MSP430FR2533</a> and <a href="#">MSP430FR2532</a> MSP430FR2633 is available in a 24-lead DSBGA package For more details see the <a href="#">device comparison</a>
Evaluation kit	CapTIvate technology development kit ( <a href="#">MSP-CAPT-FR2633</a> )
Software	<a href="#">CapTIvate Design Center</a>
Users' guide	<a href="#">CapTIvate Technology Guide</a>
TI Designs	<ul style="list-style-type: none"> <li><a href="#">Capacitive touch remote control with CapTIvate technology</a></li> <li><a href="#">Noise-tolerant capacitive touch</a></li> <li><a href="#">Touch through glass with Sharp® LCD</a></li> </ul>
Overview video	<ul style="list-style-type: none"> <li><a href="#">Low-power features of CapTIvate technology</a></li> </ul>
Technical training	<ul style="list-style-type: none"> <li><a href="#">CapTIvate technology training series</a></li> <li><a href="#">Fundamental PCB layout and design guidelines</a></li> <li><a href="#">Introduction to EMC challenges and design with CapTIvate MCUs</a></li> </ul>

## IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2017, Texas Instruments Incorporated