

Meet the  
MSP430FR5969

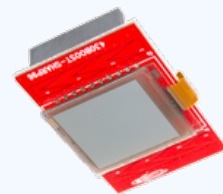
# LaunchPad

## Evaluation Kit

Part Number: MSP-EXP430FR5969

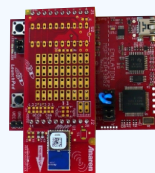
Part Number: MSP-EXP430FR5969

# BoosterPack Ecosystem



Sharp® Memory LCD  
BoosterPack

- 1.3" 96 x 96 pixel LCD (LS013B4DN04)
- 2 capacitive touch sliders
- DC/DC stepper for 5V displays
- Ultra-low-power operation



Sub-GHz RF  
BoosterPack  
- CC110L RF transceiver  
- Great RF range!  
- Includes 2x RF BoosterPacks  
- Prototyping area  
- Send & Receive RF data easily  
Only \$19

>> See them all @ [ti.com/boosterpacks](https://ti.com/boosterpacks)

## Software Tools



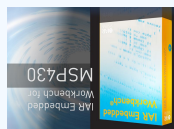
Energy  
A simple open-source &  
community-driven code  
editor.  
Easy-to-use functions for  
blinking LEDs, buzzing  
buzzers & sensing sensors.  
>> [www.energy.nu](http://www.energy.nu)

www.ti.com/ccs



Code Composer Studio™ IDE

[www.ti.com/iar](http://www.ti.com/iar)



IAR Embedded Workbench®

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- Code examples
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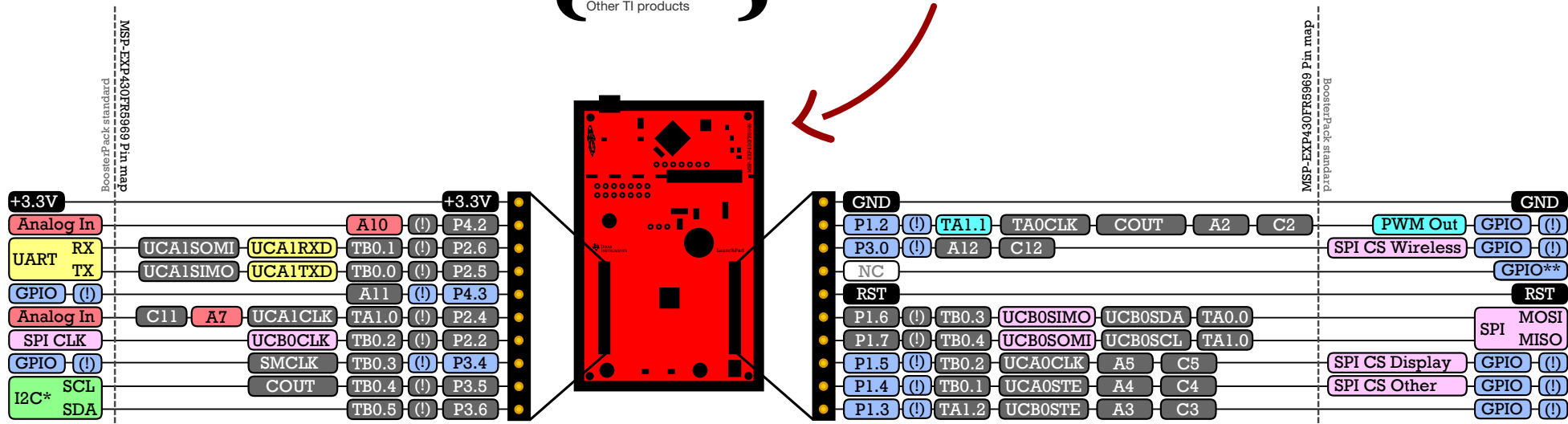
Below are the pins exposed @ the BoosterPack connector.

Also shown are functions that map with the BoosterPack standard.

\* Note that to comply with the I2C channels of the BoosterPack standard, a software-emulated I2C must be used.

\*\* Some LaunchPads do not 100% comply with the standard, please check your LaunchPad to ensure compatability

(!) Denotes I/O pins that are interrupt-capable.



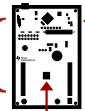
# A closer look at your new LaunchPad

Featured microcontroller: MSP430FR5969

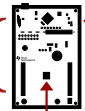
## This LaunchPad is great for...

- Battery-operated and even battery-free applications enabled by the Ultra-Low Power MSP430FR5969 MCU.
- Datalogging applications thanks to the MSP430FR5969 device's integrated 64kB of FRAM, which offers the industry's lowest power memory accesses and write speeds. FRAM also offers unprecedented write endurance.
- Power-conscious applications benefit from 100uA/MHz active modes & <500nA low power modes with self-wakeup.


## What comes in the box?




**MSP-EXP430FR5969 LaunchPad**




**eZ-FET on-board emulator**  
Enables programming, debugging & application UART via USB.  
Introducing **EnergyTrace™** technology, enabling power-aware debugging




**QSG**  
This Quick Start Guide



**Micro-USB Cable**



**Software @ ti.com/  
msp-exp430fr5969**




**MSP430FR5969 Microcontroller**


- 16 MHz CPU
- 64 kB Embedded FRAM
- 32-bit Hardware Multiplier
- Three Channel Internal DMA
- RTC with calendar & alarm
- 5x 16-bit timers
- 16-bit Cyclic Redundancy Checker (CRC)

- 16-channel analog comparator
- 16-channel 12-bit Analog-to-Digital Converter (ADC)
- 200kps @ 75uA consumption
- 256-bit AES Encryption/Decryption co-processor
- Serial communication module (eUSCI) UART, SPI, I2C
- HW UART & I2C Bootstrap Loader (BSL)


# MSP-EXP430FR5969 Overview




**eZ-FET on-board emulator**  
Enables debugging/programming as well as communication back to the PC. The eZ-FET can also provide power to the target MCU.




**Reset**




**Measure Current**  
Place ammeter in series with J9




**20-pin BoosterPack plug-in module connector (J4 & J5)**




**MSP430FR5969 Microcontroller**  
- Featuring embedded FRAM




**Button/Switch S1**




**User LEDs LED1 & LED2**




**Button/Switch S2**



**100mF (0.1F) capacitor enables battery-less applications**  
To power MSP430FR5969 with the capacitor, use the following jumper settings:  
- J11 closed to charge the capacitor  
- J12 in the "Use" position  
- Remove jumpers @ J13 to isolate emulator



**Jumpers to isolate emulator from target MCU (J13)**  
- Back-channel UART to PC (RTS, CTS, RXD, TXD)  
- Spy-bi-wire debug (RST/TST)  
- Power (5V, VCC, & GND)



**Introducing EnergyTrace Technology**  
Real-time power consumption readings & state updates from the MSP430FR5969 MCU, including CPU and peripheral state are viewable through the EnergyTrace GUI

# Out-of-box Demo

Find more information @  
[ti.com/msp-exp430fr5969](http://ti.com/msp-exp430fr5969)

## 1. Connecting to the computer

Connect the LaunchPad using the included USB cable to a computer. A green power LED should illuminate. For proper operation, drivers are needed. It is recommended to get drivers by installing an IDE such as TI's CCS or IAR EW430. Drivers are also available at [ti.com/MSPdrivers](http://ti.com/MSPdrivers).

## 2. It's alive!

When connected to your computer, the LaunchPad will power up and the Red LED (LED1) and Green LED (LED2) will toggle during the startup sequence. Now the LaunchPad will wait for commands from the GUI.

## 3. Open the Provided GUI

Download the "MSP-EXP430FR5969 Software Examples" folder (SLAC645) @ [ti.com/msp-exp430fr5969](http://ti.com/msp-exp430fr5969)  
Open the out-of-box GUI executable

## Live Temperature Mode

This mode provides live temperature data streaming to the PC GUI. Temperature is measured using the on-chip temperature sensor built into the MSP430FR5969. Data is transferred over the backchannel UART to the PC GUI.

## FRAM Logging Mode

This mode shows the FRAM data logging capabilities of the MSP430FR5969. After starting this mode, the GUI provides instructions to configure the LaunchPad to be powered from only the 100mF Super Cap. The LaunchPad will then wake up every 5 seconds (indicated by LED blink) to log both temperature and capacitor voltage values. After plugging the LaunchPad back into the PC, and reconnecting to the GUI, these values can be uploaded and graphed in the GUI.

# EnergyTrace++™ Technology

Find more information @  
[ti.com/EnergyTrace](http://ti.com/EnergyTrace)

EnergyTrace technology implements a new method for measuring MCU current consumption. EnergyTrace uses a DC-DC solution to measure the time density of charge pulses. On the MSP430FR5969 device, built in hardware enables **EnergyTrace+[CPU States]+[Peripheral States]**. The EnergyTrace technology window allows users to view power data and compare power consumption! This makes optimizing the power consumption of an application easier than ever before!

## EnergyTrace Profile

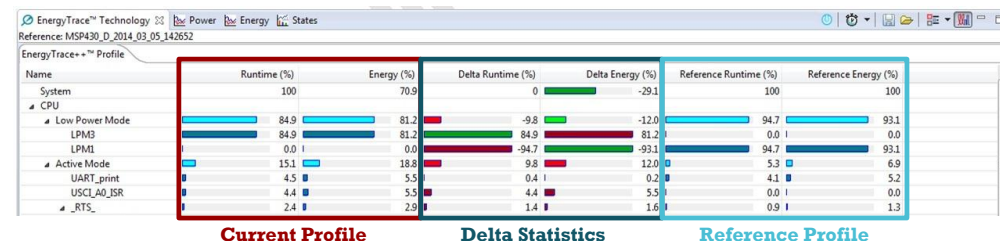
EnergyTrace Profile runtime and energy data for low power modes along with each function run during Active Mode.

## Graphical Power Data

These three tabs of the EnergyTrace Technology window show a graph over time of power, energy, and device state.

## Enable EnergyTrace Technology Window

1. Download CCS version 6.0 and newer  
- [ti.com/ccs](http://ti.com/ccs)
2. Enable EnergyTrace Technology Window  
- In CCS, click: Window>> Preferences >> Code Composer Studio >> Advanced Tools >> EnergyTrace Technology  
- Check "Enable" box  
- Select EnergyTrace+[CPU State]+[Peripheral State]
3. Debug your application to launch EnergyTrace Window



## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
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  - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
  - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
  - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
  - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

### **WARNING**

**Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.**

**User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.**

**NOTE:**

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

### 3 Regulatory Notices:

#### 3.1 United States

##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

#### CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### FCC Interference Statement for Class A EVM devices

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

#### FCC Interference Statement for Class B EVM devices

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

#### 3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see [http://www.tij.co.jp/lscs/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_01.page) 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。  
[http://www.tij.co.jp/lscs/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_01.page)

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

#### 4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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