

**Texas Instruments Innovation Challenge:  
India Analog Design Contest 2014**  
[www.ti.com/tiic-in](http://www.ti.com/tiic-in)

## Selecting the right tools for your project

### Abstract

Have you decided to take on the Texas Instruments Innovation Challenge (TIIC) by taking part in the India Analog Design Contest (IADC)? Congratulations! You have made a great decision! Since 2009, the contest has been helping engineering students across the country in building innovative electronic systems. In the "Semiconductor Tools Selection Guide," you will find tips on selecting the right integrated circuits (ICs) from Texas Instruments' Free Samples Program and the right hardware/software development tools within the stipulated budget.

### 1. What you will need when you start on a system design project

#### 1.1 Forming a team

Needless to say, you need to form a team to take part in the contest. Each team consists of a team leader, a faculty mentor, and two or more participating student members. Having a very large team is counterproductive. Make sure that all team members are equally motivated to do the project.

Some of the skills that you will need for the project are listed below. Bear this in mind when forming your team.

- ❖ Ability to select the right ICs and evaluation modules
- ❖ Ability to read the data sheets
- ❖ Hardware Design skills, including simulation and breadboarding
- ❖ PCB schematic entry, layout design and assembly (you are permitted to get this done)
- ❖ Software development in Code Composer Studio, typically using C
- ❖ Integrate different hardware blocks and software blocks and test the system
- ❖ Test your idea on some real-life examples and record the observations
- ❖ Write a technical report and make a technical presentation
- ❖ Record a good-quality video demonstration of your project

We prefer to receive proposals from 3 or more teams for a college. Each team must have a faculty mentor from the college. How will you know if other teams from your college are participating or not? If you are a student who wishes to form a team, how should you get started? You have to take the lead! You can check if your college has a website or a social media page where you can put up requests. Sometimes, when you approach a faculty mentor, he/she may be able to suggest team members. Note that a team can be formed from different departments. Similarly, a team may include a mix of UG and PG students. Sometimes, it may be difficult for you to locate a faculty mentor in your department; feel free to approach a faculty member from a related department. It is also acceptable to have a mentor from your college and a co-mentor from another organization.

#### 1.2 Writing a proposal

Your team must get together and brainstorm on what would be a good problem statement. Sometimes, your faculty mentor may be able to suggest a problem. You can also find a large number of applications documented at Texas Instruments' website – [www.ti.com/applications](http://www.ti.com/applications)

You must decide on the complexity of the project keeping in mind the skills available in your team, the academic load of each team member, the help you are likely to get from mentor/seniors, etc. Do not be overly ambitious! It is better to complete a reasonable-sized project than do an incomplete job on a complex one!

While coming up with problem statements, keep in mind on how you will test the final project. Some projects look great on paper, but will pose many challenges when you want to actually build/test the prototype.

You may wish to look at the projects carried out by teams which participated in the contest in past years. You will find YouTube video demonstrations of these projects. However, we urge you to be original and innovative in coming up with your problem statement.

Your proposal must be made in the format suggested on our website and submitted as per our guidelines. The team leader must be responsible for all communications with TI and must follow the guidelines we provide.

## 2 Selection of components

Your project may require electronic components and mechanical fixtures, etc. Among the electronic components, TI can provide you the semiconductors free of cost (read below). If you need components such as capacitors, resistors, or inductors, you must purchase them. Find out if there is any financial support that you can garner from other sources.

We can provide IC samples and some hardware development boards to you free of cost to implement your project. Similarly, note that TI provides many software programs free of cost to students – e.g. Code Composer Studio (Student Edition), FilterPro, PowerPro, SwitcherPro, etc. These software programs can be downloaded from our website.

The rules of the contest are: (a) use at least three analog chips from TI **or** (b) use at least two analog chips from TI and a TI embedded processor. Teams are expected to identify the appropriate set of TI ICs and EVM(s) for their projects and submit the list in the format given below. Teams are requested to upload their TI components requirement along with their project proposal online on <http://www.tinyurl.com/tiic-india-adc-2014> before August 15, 2013.

**TI makes over 80,000 ICs (Analog & Embedded Processors), visit [www.ti.com](http://www.ti.com) for details.**

**Read Sections 2.1 and 2.2 to simplify your search for the right components.**

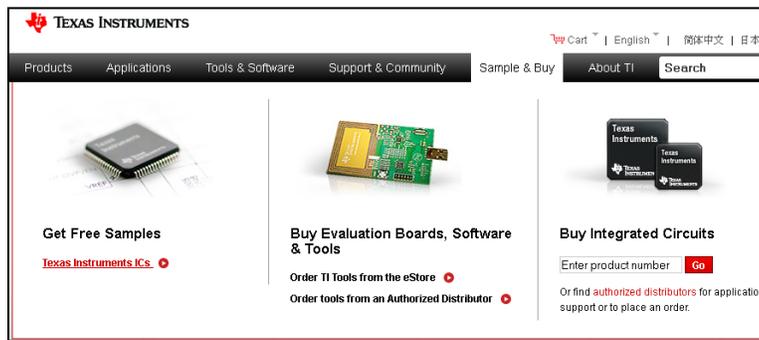
### 2.1 Guidelines for Selecting the TI Integrated Circuits (ICs)

1. When requesting for semiconductor ICs, please ensure that the ICs are available in the free samples program of Texas Instruments.

2. You can visit [www.ti.com](http://www.ti.com) and click on the "Sample and Buy" link to find out what ICs are available in the free samples program. The same IC may be available in multiple packages. You must specify the exact package (from the free samples list).
3. To choose the right IC package please see datasheet of the IC which is available in [www.ti.com](http://www.ti.com). You will also find pictorial representation of IC package in the datasheet. Please be aware that some IC package requires sophisticated soldering facilities.
4. You can select up to 5 - 10 different types of ICs. We recommend you to request for at least 5 samples for each IC type you select.
5. ICs that are not available in TI free samples program **WILL NOT** be provided by TI. You can purchase any such IC from our distributors like Digikey, element14, AVNET etc.
6. Passive components like registers, capacitors, inductors and other non-ti components like LCD, LED display, connecting wires, PCB etc will not be provided by TI. Please don't include them in your component request.
7. Here is a list of TI ICs that you may wish to consider for your project. This list is just for your reference. You can request for any IC from TI free samples program depending upon your project requirements.

<b>Op-Amps &amp; Amplifiers</b>	<b>Power Management</b>
1. UA741CP-General-Purpose Operational Amplifier	1.TPS73501 - LDO
2. OPA227P-High Precision Operational Amplifiers	2.BQ24753A - Multi-Cell Li-Ion Charger
3. TL082CP-JFET-Input Operational Amplifier	3.UCD9080 - Power Sequencer
4. LM833N-Dual Audio Operational Amplifier	4.TLC5940 - LED Driver
5. INA114AP-Precision Instrumentation Amplifier	5.UCC28600 - AC/DC Controller
6. TPA3122D2N-15-W Stereo Class-D Audio Power Amplifier	6.TPS63000, TPS62400, TPS61200 - Buck/ Boost Converters
7. LM293P-Dual Differential Comparator	7.TPS5430, TPS40200 - Wide-Input Buck
<b>Switches</b>	8.TPS54010, TPS40055 - High Current Buck
1.TS12A4517 - Low-voltage, low on-state resistance SPST CMOS analog switches	9.CSD16413Q5A - MOSFET
<b>Data Converters</b>	<b>Drivers &amp; Sensors</b>
1. THS1206M - General Purpose ADC	1. CD4056B-BCD to 7 Segment Decoder Driver
2. ADS1258 - Instrumentation ADC	2. TLC5940NT-16 Channel LED Drivers
3. ADS1605, ADS1606 - High Speed ADC	3. MM5483-LCD Driver
4. DAC8554 - General Purpose DAC	4. L293-Half-H Drivers for moto, relay, solenoids etc
5. DAC8534 - High Precision DAC	5. CSD18503KCS-N-Channel Power MOSFET
6. DAC8581 - High Speed DAC	6. LM35CAZ-Temp sensor
	7. OPT101P-Photodiode

8. Here are the Steps to see if the TI IC is available in free samples program
  1. Visit [www.ti.com](http://www.ti.com) , Click on "Get Free Samples" on "Sample & Buy" Menu



2. Log-in to your my.ti.com account. If you don't have an account then create one.

my.TI Account

**Login to Request Samples**

**Existing my.TI user?**

Your email address:

Your my.TI password:

Remember me [?](#)

**Log in**

[Forgot your password?](#)

3. Enter the exact part number of the TI IC you wish to request. In order to know the exact part number of the TI IC, please visit [www.ti.com](http://www.ti.com). We advise you the visit the datasheet of the IC and select the appropriate IC package before you proceed for Step 3.

1. Samples Cart > 2. Shipping > 3. End Customer > 4. Order

**Samples Cart**

0 item(s) in cart. You can checkout a maximum of 20 items.

Your Samples Cart is empty

Search for Samples:  **Go**

Free samples are **"Not for Resale"**

\* Samples will be shipped to **INDIA** [\(Edit\)](#)

4. Let us say you wish to order TL082. Enter TL082 in the cell shown in above window and click Go. You will be directed to following page: -

**Search for Samples**

TI082  > [Advanced Search](#)

30 Results

Item	Pkg	Pb-Free/Green	Stock Status	Each	<input type="button" value="Add to Cart"/>
<b>TL082</b> - JFET-Input Operational Amplifier					
<a href="#">TL082CDR</a>	D	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CDRE4</a>	D	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CDRG4</a>	D	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CP</a>	P	All Pb-Free	In Stock	\$0.00	<input checked="" type="checkbox"/>
<a href="#">TL082CPE4</a>	P	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CPWR</a>	PW	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CPWRE4</a>	PW	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082CPWRG4</a>	PW	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>
<a href="#">TL082IDR</a>	D	All Pb-Free	In Stock	\$0.00	<input type="checkbox"/>

From the data sheet, you will know that TL082CP is a DIP package. A checkbox against it in the last column which means it is available in free samples and you can request for the same.

Note: -

- ❖ If last column doesn't contain checkbox against any particular IC package it means that IC package is not available in free sample program and you cannot request it.
  - ❖ If any IC package has "back ordered" written against it, then you cannot request it no matter if it is available in free samples.
  - ❖ Back ordered means the IC is under short supply and may not be available immediately.
5. If you have completed these four steps and you are sure which IC you wish to request. Please enter the exact part number with package information in the components request form given below.

**[2.2 Guidelines for Selecting TI hardware development tools \(Evaluation Module \(EVM\)/Target boards/Kits\)](#)**

TI can provide you a selection of hardware development tools for simplifying your project development. The total value of the hardware development tools must be limited to \$200 per team. If there are more than 3 teams from a college, then hardware development tools must be shared among teams. Teams are allowed to pool their budgets. If your hardware development tools requirement is not fitting inside the budget allocated to each team. You can purchase some of the hardware development tools from TI estore – <https://estore.ti.com>

Students working on projects typically need Analog EVMs and hardware tools based on TI's embedded processors. Please note:

1. You may select Analog EVMs by visiting [www.ti.com/analog](http://www.ti.com/analog); locate the EVM which you wish to request and write down its part number.
2. This year, we have simplified the ordering of embedded processing tools by providing a list from which you can select. We have included below a list of tools based on TI DSP, TI MCU, TI MPU, TI LPRF products. Please restrict your selection to the list provided below.

3. TI has application specific EVMs/Kits as well. If you need any application specific TI EVM for your project, you must justify your request. We will evaluate your reasons before accepting or rejecting your request.
4. You must work within the budget given to you when ordering the hardware tools. The cost of IC samples need not be considered in the costing when you make up your component list.

S.NO.	Platform	Prescribed list of TI EVMs/kits/boards
1	Analog	ASLKV2010 Starter Kit
		Analog Front End (AFE) Sensor boards
		Data Converters
		Power
		Amplifiers
		Drivers and Control
		Logic
		Interface
2	MCU (MSP430)	MSP-EXP430G2
		MSP430 Launchpad Booster kits (RF, touchsense, audio CC110L, TMP006 etc)
		MSP-EXP430F5529
		MSP-EXP430F5438
		MSP-EXP430FG4618
		MSP-FET430UIF
3	MCU(C2000)	LAUNCHXL-F28027
		BOOSTXL-C2KLED
		TMDSDOCK28335
		TMDSPREX28335
4	MCU (TIVA C Series) formerly Stellaris	EK-TM4C123GXL
		BOOSTXL-SENSHUB
		Stellaris Guru Evaluation Kit
		EKS-EVALBOT
5	Low Power RF (LPRF)	EZ430-F2013
		EZ430-RF2500
		EZ430-RF2500-SEH
		EZ430-RF2500T
		EZ430-RF256X
		CC2500EMK
		CC3000FRAMEMK
		CC4000GPSEM
6	MPU	Beagle Board-xM
		Beagle Bone Black
		TMDSSK3358
7	DSP	TMDX5535EZDSP
8	Miscellaneous	Specific Application based board/kit

Once you select the appropriate TI EVM for your project, please enter the exact part number of the same in the components request form given below.

### 2.3 Component Request Form

1. [Click here](#) to download the component request form.
2. Please upload this component request form on the CMT website (<http://tinyurl.com/tiic-india-adc-2014> )along with your project proposal by August 15, 2013
3. You must name your file as component-request.xls, before you upload it on CMT.

### 3 Conclusions

We hope that this document has been useful to you in deciding and requesting the hardware tools for your project.

## IMPORTANT NOTICE

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Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)