About Microcontroller Trainers

Out of all CPUs (Microcontrollers & Microprocessors) active on the globe (approximately 18 billion), 94% CPUs are used in embedded applications and only 6% are used in computers of all size & shape.In this exiting era of embedded systems, proper understanding & practical learning of embedded systems will enhance career prospects for the students.

National Infotech has developed a range of microcontroller trainers and add-on cards to provide student a complete platform to launch their career in embedded systems.At entry level we offer basic and enhanced 8051 microcontroller kitand add-on cards. At intermediate level we have a lightning fast Silicon Labs 8051 board NIKIT-SI-51 (speed 100 MIPS). For 32-bit platform at advanced level, we have one of the most promising architecture namely ARM CORTEX M4. This will enable many imaginative experiments with modeling and testing. A range of Power Electronics cards for rapid development of prototype is also developed.

About Manufacturer

National Infotech (A National Group Company) is working in the field of power electronics, embedded system development,industrial automation and project engineering. National Infotech also imparts professional training on embedded systems and industrial automation.

NITech

NATIONAL INFOTECH

A way to Power Electronics and Embedded Systems Solutions...

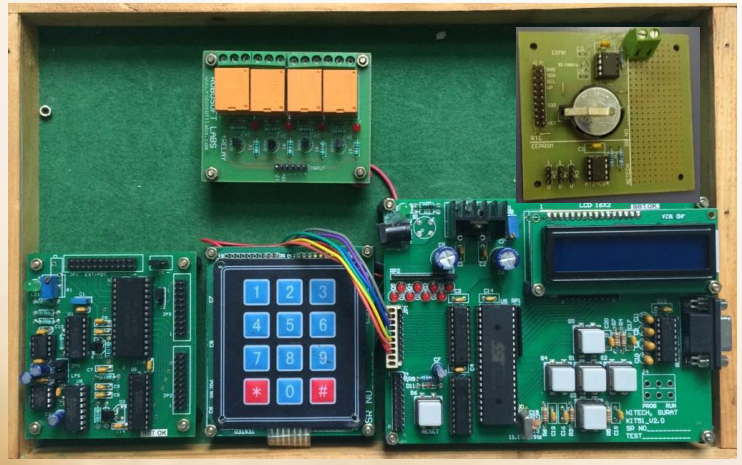
MICROCONTROLLER KITS & POWER ELECTRONICS CARDS

: Authorized Distributor :

NIC01: 8051 Microcontroller Kit with Peripheral Cards

8051 Microcontroller Kit with Peripheral Cards comprising of following units:

- 8051 Microcontroller Starter kit with ISP facility
- 8-bit Parallel ADC/DAC Card
- I2C Card with RTC and EEPROM
- Matrix Keyboard
- Relay Card



Features of these cards are detailed one by one below.

8051 Microcontroller Starter kit:

NI KIT-51 is a development kit to learn basics of microcontroller. It is developed using Microchip's SST microcontroller. Flash memory controllers with ISP facility are easily programmed with the help of a serial port of PC. This eliminates the need of Universal Programmers to load programs in the controller's memory. Microchip's controllers' flash memory is available up to 64KB flash size and 2KB of internal RAM. All I/O ports of the controller are available on the expansion bus thereby increasing the options for interfacing other devices. This kit allows both simple and complex embedded application development with 8051 microcontroller family.

Microcontroller Starter Kit (NI KIT-51) consists of:

- The NI KIT-51 board fitted with a Microchip's flash microcontroller
- A serial cable to connect NI KIT-51 to PC
- On board power supply and mains cable
- Evaluation version of the 8051 development tools which includes a C cross compiler, Assembler, Debugger and on-line manuals
- SSTFlashFlex51 ISP utility for programming microcontroller

Minimum System Requirements for Evaluation of software and ISP:

- Windows 98, Windows NT Version, Windows 2000, Windows XP
- Mouse or similar pointing device
- 300 Megabytes free hard disk space
- 128 Megabytes of RAM

Demo Codes ProvidedFor Practice:

CD ROM available with this kit contains well commented programs in embedded 'C' andassembly language.

- GPIO Code
- Keyboard Interfacing Code
- LCD Interfacing Code
- Serial data Communication(UART)
- Timer Code
- Seven Segment Display interfacing Code
- 8 Bit parallel ADC/DAC Code
- I2C/RTC Code
- Matrix Keyboard Code
- Relay Code

Key Features:

- Microchip's SST microcontroller SST89E516RD
- On chip 64KB flash memory and 1KB RAM
- ISP/IAP programming mode
- 12 clock/ 6 clock operating mode
- Crystal 18.432 MHz
- 16 X 2 Alpha-numeric LCD Display Module
- 5 nos. of user programmable keys
- 8 nos. of LEDs on Port1
- On board four nos. of seven segment display interfacing
- On board System reset key
- RS232 port for programming/pc serial communication
- All Port pins on expansion connectors
- Buffered and Non-Buffered port pins with easy expansion connectors
- All ICs on round pin IC-Sockets
- Powder coated metallic enclosure
- Easy flash memory programming with the serial port of a computer
- On board power regulator and power on LED

- Re-settable Fuse for short circuit protection and over voltage protection
- Hex file can be downloaded easily with the help of user friendly ISP software
- A variety of Microcontroller ICs (8051 family, DIP 40 pin with flash memory) are supported by the kit
- One year warranty against manufacturing defect

8-Bit Parallel ADC/DAC Card:

NI KIT-51 comes with a provision for a range of add-on cards. These cards providevalue added interfaces that are not available on board. ADC/DAC add-on cardincludes an 8-bit ADC and 8-bit DAC. It has ADC0808 an 8 bit analog to digitalconverter with on chip 8 channel multiplexer, conversion time of 100-200 uSecond and microprocessor compatible control logic. The module has monolithic 8-bit highspeed current-output digital-to-analog converters DAC-0800 featuring typical settlingtimes of 100 ns.The 8-bit A/D-converter uses successive approximation as theconversion technique. The converter features a high impedance chopper stabilizedcomparator, a 256R voltage divider with analog switch tree and a successiveapproximation register. The 8-channel multiplexer can directly access any of 8single-endedanalogsignals.Themoduleeliminatestheneedforexternalzeroandfull-scaleadjustments.Easyinterfacingto NIKIT-51is provided by the wired bus.
The 8-bit D/A-converter current-output is converted to voltage-output with the helpof Op-Amp circuitry for easy interface.
The specifications of ADC 0808 and DAC 0800 are as follows:

ADC 0808:

- +5V power supply from NI KIT-51 (no external power supply).
- All signals of the ADC-board can be connected to the NI KIT-51.
- Operates with external reference of 2.5 Volt.
- Typical conversion time 100-200 uSecond based on ADC clock.
- No zero or full-scale adjust required.
- 8-channel ADC with multiplexed address logic.
- Outputs meet TTL voltage level specifications.
- On board potentiometer for variable voltage source

DAC 0800:

- Fast settling output current: 100 ns
- Full scale error: ±1 LSB
- Nonlinearity over temperature: ±0.1%
- Full scale current drift: ±10 ppm/°C
- High output compliance: -10V to +18V
- Complementary current outputs Interface directly with TTL and

I/O Specifications:

ADC Input Voltage	:	Min: 0 V Max: +2.5 V
ADC Reference (Vref)	:	0 to +2.5 V
DAC Reference (Vref)	:	0 to +2.5 V
DAC Output Voltage Swing	:	-2.5 to 2.5 V [jumper selectable]
Supply Voltage (VCC)	:	5.0V
Max. Analog voltage Output	:	0 TO 2.5 Vppuni-polar -2.5 TO +2.5 Vpp bi-polar
Voltage at Control Inputs	:	-0.3V to +5V

Key Features:

- 8-bit Multiplexed 8-channel ADC 0808
- 8-bit high speed DAC 0800
- ADC Operates with external reference of 2.5 V
- Typical ADC conversion time 100-200 uSecond
- DAC has fast settling output current: 100 ns
- Full scale error: ±1 LSB
- Nonlinearity over temperature: ±0.1%
- Full scale current drift: ±10 ppm/°C
- High output compliance: -10V to +18V
- Outputs meet TTL voltage level specifications

I2C Card with RTC and EEPROM:

The I2C module is equipped with RTC and EEPROM ICs. The DS1307 Serial Real Time Clock is a low–power, full BCD clock/calendar IC having 56 bytes on-chip Non-volatile SRAM. Address and data are transferred serially via the 2–wire bi–

directional I2C bus. AT24C04A is a 4K x 8 (512 Kbit) Serial Electrically Erasable PROM (EEPROMs). It has been developed for advanced, low-power applications such as personal communications and data acquisition. This device also has a page write capability of up to 128 bytes of data. Easy interfacing to NI KIT-51 is provided by thewired bus.

I/O Specifications:

- Supply Voltage (VCC) : 5.0V
- RTC : (SCL, SDA, X2, X1, V, SQW / OUT)
- EEPROM : (SCL, SDA, A2, A1, A0, WP)

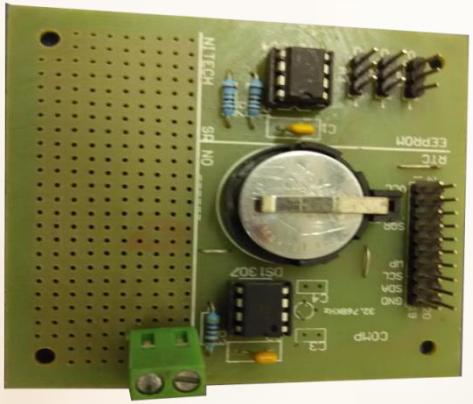
Specifications:

RTC Specifications:

- +5 V power supply from NI KIT-51 (no external power supply).
- All signals of the I2C-board can be connected to the NI KIT-51.
- Easy interface to all microcontrollers.
- Real time clock counts seconds, minutes, hours, date of month, month, day of week and year with leap year compensation valid up to 2100.
- 56 byte nonvolatile SRAM for general data storage.
- 2-Wire Serial interface (I2C).
- Programmable Square-Wave Output Signal.
- Automatic power fail detect.
- Consumes less than 500 nA for battery back-up at 25'C.

EEPROM Specifications:

- Internally Organized 128 x 8 (1K), 256 x 8 (2K), 512 x 8 (4K), 1024 x 8 (8K) or 2048 x 8 (16K)
- 2-Wire Serial Interface (I2C)
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- 100 kHz (1.8V, 2.5V, 2.7V) and 400 kHz (5V) Compatibility
- Write Protect Pin for Hardware Data Protection
- 8-Byte Page (1K, 2K), 16-Byte Page (4K, 8K, 16K) Write Modes
- Partial Page Writes Are Allowed
- Self-Timed Write Cycle (10 ms max)
- High Reliability
- Endurance: 1 Million Write Cycles
- Data Retention: 100 Years
- ESD Protection: >3000V
- Automotive Grade and Extended Temperature Devices Available
- 8-Pin and 14-Pin JEDEC SOIC, 8-Pin PDIP, 8-Pin MSOP, and 8-Pin TSSOPPackages 2-Wire



Key Features:

- Real time clock valid up to 2100.
- RTC IC DS1307 with 56 bytes of battery backed nonvolatile SRAM
- 2-Wire Serial interface (I2C)
- Programmable Square-Wave Output Signal
- Automatic power fail detect
- 256 x 8 bits or 256 bytes EEPROM
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- Write Protect Pin for Hardware Data Protection 8-Byte Page (2K)
- Write Modes up to 400 kHz I2C clock rate
- Partial Page Writes Are Allowed

Applications:

RTC Applications:

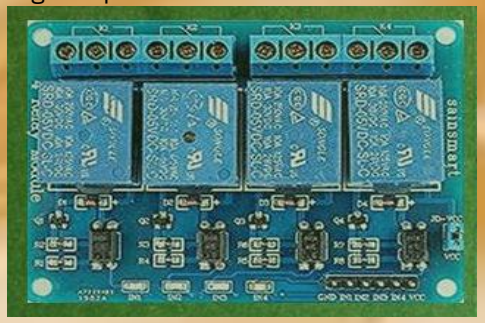
- Digital Clock
- Attendance System
- Digital Camera
- In Applications where time stamp is needed

EEPROM Applications:

- In Real Time Clock
- Digital Temperature Sensors
- To Store Calibration Information
- To Store the data that needs to be available on the event of power loss

Relay Card:

- 4-Channel Relay interface board
- Equipped with high-current relay, Rating are as follows:
  1) 7A-250V AC
  2) 10A-125V AC
  3) 12A 120V DC
  4) 10A 28V DC
- Standard interface that can be controlled directly by microcontroller
- Has the fixed bolt hole and easy installation
- Small board PCB size
- four ways of relay status indicator LED (red)
- Module interface specifications (6 wires)
- External 12V
- GND (external GND)
- 1N1-1N4 interchange relay control interface by single chip IO



NIC02: AVR ATMega32 Microcontroller Kit

NI ATMEGA32 is a development kit with AVR microcontroller. AVR controllers' flash memory is available up to 32KB flash size and 2KB of internal RAM. All I/O ports of the controller are available on the expansion bus thereby increasing the options for interfacing other devices.

ATMEGA32 Kit consists of the following peripherals:

- RS-232 Interface (For direct connection to PC's serial port)
- On board Two Line LCD Display (2x16)
- On board I2C RTC (DS 1307) with Crystal and Battery
- Four multiplexed 7-Segment LED Display
- Built in Pull-Up (5 Keys) Keyboard
- Built in IR Sensor Interface – TSOP 1738
- Built in 8 LED Interface to test I/O
- On Board External Interrupt and Reset buttons
- Built in Potentiometer interface to ADC
- On Board Temperature Sensor Interface (LM35)
- On Board Buzzer Interface
- On Board PWM Output pin
- On Board JTAG Connector for Debugging/Programming
- On Board ISP Connector
- On Board 16 MHz Crystal Oscillator
- On Board Power LED Indicator
- On Board DB9 Connector
- All Port Pins available at IDC (2x5) Connector

Demo Codes Provided For Practice:

Following is a list of the sample codes given in the CD to start working with the kit.

- GPIO port pin toggle Demo Code
- Keyboard Demo Code
- LCD Demo Code
- LEDs toggling pattern Demo Code
- Seven Segment Display Demo Code
- SPI based IO Expander Demo Code
- Temperature Sensor Demo Code
- Timer Interrupt Demo Code
- Timer PWM Demo Code
- Buzzer Demo Code
- ADC Demo Code
- I2C Demo Code
- IR Tx - Rx Demo Code
- UART Demo Code
- DC Motor Drive Demo Code
- External Interrupt Demo Code

Software Requirement:

- Atmel Studio 7
- Khazama AVR Programmer
- Sample Codes for all On board peripheral

Key Features:

The Key features of NI ATMEGA32 Kit are listed below:

- Standard ATMEGA32 CPU with 11.0592 MHz clock
- Power ON Reset and Manual Reset
- Power indicating LED
- On board Regulated power supply
- 12V (300mA), 5V, and Ground source for external connection
- Port Extension for all ports (PA, PB, PC & PD)
- ISP pins/connector for programming the microcontroller
- 8 LED Array
- 16x2 character LCD & Four 7-Segment multiplexed display
- On board Buzzer for audible output
- On board 5 Switch array (joystick formation)
- Motor Driver Stepper Motor / 2 DC Motor Control
- RS232 to TTL converter
- No need to remove microcontroller from the board
- Extended pins to connect the modules as per requirements
- 32 K on chip Flash program memory,1024 Bytes EEPROM
- One header for 7 channels 10 bit ADC
- External interrupt input
- On-board I2C, SPI, UART connectors(with 9 pin D-type Connector)
- Supplied in a wooden box packing
- Compatible with different educational practice boards and Arduino Board
- USB ASP third party programmer

Minimum System Requirement:

- Windows 95/98/ME/NT/2000/XP
- Mouse
- COM Port
- 16Mb RAM

NIC03: SI Labs Advanced 8051 Microcontroller Kit

SI Labs Advanced 8051 Microcontroller Kit (NIKIT-SI-51) is 100 MIPS 8051 microcontroller family. Itis developed for the Silicon Laboratories' C8051F12x Development Kit containing C8051F120 Target Board, JTAG Debugger, IDE and other accessories. A 96-pin Expansion I/O connector is provided on C8051F120 Target Board which can be connected to Silicon Laboratories' Buffer Card using EURO 96 connector. All I/O pins of Silicon Laboratories' Buffer Card are buffered and interfacing keyboard, LCD, DI, DO, AI, AO, LED, Serial Communication made 5 V tolerance and easy. On-chip MAC unit for fast calculation, on-chip 12-bit 8-channel ADC (100KSPS), on-chip 10bit DAC are other useful feature on 8051 core of this kit.

Key Features:

- High-Speed pipelined 8051-compatible CIP-51 microcontroller core (up to 100 MIPS)
- In-system, full-speed, non-intrusive debug interface (on-chip)
- 50 MIPS for C8051F124/5/6/7)
- On-chip MAC Unit for fast calculation
- Buffered 5 V Tolerance I/O pins
- Keyboard Interfacing
- 16 X 2 LCD Interfacing
- 2 UART for Serial Communication
- Analog output with adjustable gain
- On-chip 12-bit 8-channel ADC (100 KSPS)with PGA and 8-channel analogmultiplexer
- On-chip 8-bit 8-channel ADC (500 KSPS)
- On-chip 10 bit DACwith programmable update scheduling
- 128k bytes of in-system programmable FLASH memory
- 8448 (8k + 256) bytes of on-chip RAM
- External Data Memory Interface with 64k byte address space
- SPI, SMBus/I2C, and two UART serial interfaces implemented in hardware
- Programmable Counter/Timer Array with 6 capture/compare modules
- On-chip Watchdog Timer, VDD Monitor, and Temperature Sensor
- LED on Port pins
- Five general purpose 16-bit Timers
- +5 V Regulated Power Supply
- DSP Experiments possible
- With on-chip VDD monitor, Watchdog Timer, and clock oscillator, the C8051F12x devices are truly stand-alone System-on-a-Chip solutions
- On-board JTAG debug circuitry allows non-intrusive (uses no on-chip resources), full speed, in-circuit debugging using the production MCU installed in the final application
- Each MCU is specified for 2.7 V-to-3.6 V operation over the industrial temperature range (-45° C to +85° C)
- The Port I/Os, /RST, and JTAG pins are tolerant for input signals up to 5 V
- All analog and digital peripherals are enabled/disabled and configured by user firmware
- The FLASH memory can be reprogrammed even in-circuit, providing non-volatile data storage, and also allowing field upgrades of the 8051 firmware.

Minimum System Requirements for Evaluation of software and ISP:

- Windows 98, Windows NT Version 4, Windows
- 2000, Windows XP
- Mouse or Similar Pointing Device
- 300 Megabytes Free Hard Disk Space
- 128 Megabytes of RAM
- Silicon Laboratories IDE
- USB Debug Adapter
- JTAG interface

Demo Codes Provided For Practice:

- GPIO demo code using key/LED
- Timer demo code using PLL
- External Crystal demo code
- Timer 0 in 16bit mode demo code
- Timer 2 demo code for toggling a variable
- PCA demo code
- UART transmission demo code
- ADC demo code by UART
- ADC demo code by PCA
- NI-Advanced-SI-51 all peripheral demo code

NIC04: ARM Cortex M4 32-Bit Microcontroller Kit

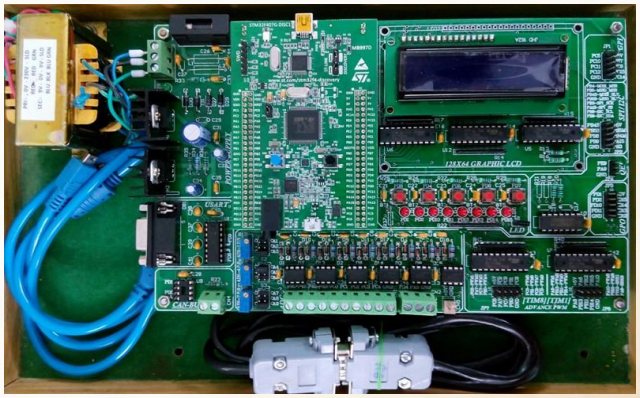
NI CM4ARMis a trainer kit based on STM32F407VGT6device; a member of CORTEX M4 based 32-bit microcontroller's family.STM32F407VGT6 is a Flash memory based controller having hardware debugging facility withIn-System programming capability, eliminating the need for Universal Programmer to loadprograms in the controller's memory.DISCOVERY board developed by STMicroelectronics is used as a daughter board. A mother board with buffers, push buttons keys,LCD display, and RS-232 port is provided.

NI CM4-ARM Microcontroller Starter Kit consists of:

- Two boards:
  1) Daughter board: This board is ST Discovery card for STM32F407VGT6 microcontroller running at 168 MHz
  2) Mother board: This board is developed to provide buffering and signal conditioning of various signals of discovery card
- A USB cable to connect the daughter board (Discovery) for hardware debugging and programming of the microcontroller
- Power supply with transformer and mains cable
- Evaluation version of the Keil MDK-ARM Development Kit which includes a C cross compiler, assembler, debugger and on-line manuals
- Code examples for various peripherals for practice

Key Features:

- STM32F407VGT6microcontroller featuring 1MB of Flash memory, 192 KB of RAM in an LQFP100 package running at 168 MHz (max) providing peak throughput of 210MIPs
- On-board ST-LINK/V2 debugger for hardware level debugging (SWD connector for programming and debugging)
- 3×12-bit, 2.4MSPS A/D converters: up to 24 channels (simultaneous sampling of all three ADCs is possible)
- General-purpose DMA: 16-stream DMA controller with FIFOs and burst support
- Up to 17 timers: up to twelve 16-bit and two 32-bit timers up to 168MHz, each with up to 4 IC/OC/PWM or pulse counter and quadrature (incremental) encoder input
- Board power supply: through USB bus or from an external 12V AC supply
- LIS302DL, ST MEMS motion sensor, 3-axis digital output accelerometer
- MP45DT02, ST MEMS audio sensor, Omni-directional digital microphone
- CS43L22, audio DAC with integrated class D speaker driver
- Eight LEDs:
  - LD1 (red/green) for USB communication, LD2 (red) for 3.3 V power on
  - Four user LEDs, LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)
  - 2 USB OTG LEDs LD7 (green) VBus and LD8 (red) over-current
- Two push buttons (user and reset)
- USB OTG FS with micro-AB connector
- GPIO ports are routed to header on mother board for easy connection (5V tolerant GPIO pins)
  - 8 General purpose input lines, 8 General purpose output lines
  - 16X2 LCD interface, 5 keys interface.
  - 4 high speed digital outputs and 2 High speed digital input lines.
  - 6 PWM outputs with programmable dead time insertion, 3 QEI inputs.
  - SPI bus for SPI slave interface.
  - 9 Analog inputs for AC signal interface.
  - 2 DAC outputs (0-3.3 V)
  - 9-pin D-type connector for RS232 interfaces.
- AUTO Code generation from MATLAB



Demo Codes Provided For Practice:

- GPIO code examples(gpio_write,gpio_read_write,gpio_lcd)
- USART code example
- TIMER code examples(time base, timer output compare, pwm_timer, pwm_key)
- FREQ_MEASURMENT_LCD code examples (freq_meas, freq_meas_avg, freq_meas_avg_filter)
- ADC code example
- DAC RAMP WAVE code example
- ADC_DAC code example
- ADC_DMA_TRUE_RMS_ MEAS code example

NIC05: 8051 Microcontroller Kit

NI KIT-51 is a development kit to learn basics of microcontroller. It is developed using Microchip's SST microcontroller. Flash memory controllers with ISP facility are easily programmed with the help of a serial port of PC. This eliminates the need of Universal Programmers to load programs in the controller's memory. Microchip's controllers' flash memory is available up to 64KB flash size and 2KB of internal RAM. All I/O ports of the controller are available on the expansion bus thereby increasing the options for interfacing other devices. This kit allows both simple and complex embedded application development with 8051 microcontroller family.

Microcontroller Starter Kit (NI KIT-51) consists of:

- The NI KIT-51 board fitted with a Microchip's flash microcontroller
- A serial cable to connect NI KIT-51 to PC
- On board power supply and mains cable
- Evaluation version of the 8051 development tools which includes a C cross compiler, Assembler, Debugger and on-line manuals
- SSTFlashFlex51 ISP utility for programming microcontroller

Minimum System Requirements for Evaluation of software and ISP:

- Windows 98, Windows NT Version, Windows 2000, Windows XP
- Mouse or similar pointing device
- 300 Megabytes free hard disk space
- 128 Megabytes of RAM

Demo Codes Provided For Practice:

CD ROM available with this kit contains well commented programs in embedded 'C' and assembly language.

- GPIO Code
- Keyboard Interfacing Code
- LCD Interfacing Code
- Serial data Communication(UART)
- Timer Code
- Seven Segment Display interfacing Code
- 8 Bit parallel ADC/DAC Code
- I2C/RTC Code
- Matrix Keyboard Code
- Relay Code

Key Features:

- Microchip's SST microcontroller SST89E516RD
- On chip 64KB flash memory and 1KB RAM
- ISP/IAP programming mode
- 12 clock/ 6 clock operating mode
- Crystal 18.432 MHz
- 16 X 2 Alpha-numeric LCD Display Module
- 5 nos. of user programmable keys
- 8 nos. of LEDs on Port1
- On board four nos. of seven segment display interfacing
- On board System reset key
- RS232 port for programming/pc serial communication
- All Port pins on expansion connectors
- Buffered and Non-Buffered port pins with easy expansion connectors
- All ICs on round pin IC-Sockets
- Powder coated metallic enclosure
- Easy flash memory programming with the serial port of a computer
- On board power regulator and power on LED
- Re-settable Fuse for short circuit protection and over voltage protection
- Hex file can be downloaded easily with the help of user friendly ISP software
- A variety of Microcontroller ICs (8051 family, DIP 40 pin with flash memory) are supported by the kit
- One year warranty against manufacturing defect

NIAC01: SPI Based 12-bitADC-DAC Card

The SPI Based AD-DA module is equipped with 13-bit SAR ADC and 12-bit DAC ICs. The MCP3302 is 13-Bit 4 single ended/2 Differential channel Low Power A/D Converter with High Speed SPI Serial Interface. The module has MCP 4822 12-Bit DAC with Internal Voltage reference and High Speed SPI Serial Interface. Data are transferred serially via the 3–wire bi–directional SPI bus. Optical isolation between NI-KIT-51 and the ADC/DAC module is providedwith the help of high speed optocouplers 6N137 on SPIbus. It has been developed for fast data acquisition applications. Easy interfacing to NI KIT-51 is provided by the wired bus.

Brief Description of ADC-DAC Module:

ADC Description:

The MCP3302 13-bit A/D converter features full differential inputs and low power consumption in a small package that is ideal for battery powered systems and remote data acquisition applications. The MCP3302 is programmable to provide two differential input pairs or four single ended inputs.

The MCP3302 devices feature low current design that permits operation with typical standby and active currents of only 50 nA and 300 µA, respectively. The devices operate over a broad voltage range of 2.7V to 5.5V and are capable of conversion rates of up to 100 ksps. The reference voltage of 2.5 V provides analog resolution of 0.61mv per ADC count. The MCP482X devices are 2.7V–5.5V, low-power, low DNL, 12-bit Digital-toAnalog Converters (DACs) with internal band gap voltage reference, optional 2x-buffered output and Serial Peripheral Interface (SPI).

DAC Description:

The MCP482X family of DACs provides high accuracy and low noise performance for industrial applications where calibration or compensation of signals (such as temperature, pressure and humidity) is required. The MCP482X devices are available in the extended temperature range and PDIP, SOIC and MSOP packages. The MCP482X devices utilize resistive string architecture, with its inherent advantages of low DNL error, low ratio metric temperature coefficient and fast settling time. These devices are specified over the extended temperature range. The MCP482X family includes double-buffered registers, allowing simultaneous updates using the LDAC pin. These devices also incorporate a Power-On Reset (POR) circuit to ensure reliable power-up.

Key Features:

- 13-bit SAR A/D Converters MCP 3302 up to 100 ksps
- 2 nos. of 12-bit D/A Converters on IC MCP-4822
- Voltage outputs as out0 & out1
- Two SPI Interface with 20MHz Clock Support
- Fast Setting Time 0f 4.5µs
- 2.048 V (with 1x2.048 V / 2x2.048 V) internal voltage reference for DAC
- 4.096 V external voltage reference for ADC
- 2 differential or 4 single ended analog inputs

Specifications:

ADC MCP-3302:

- 13-bit A/D Converters.
- AN0 to AN3 General purpose Digital Input
- Single supply operation: 2.7V to 5.5V
- 100 ksps sampling rate with 5V supply voltage
- 50 ksps sampling rate with 2.7V supply voltage
- Industrial temp range: -40°C to +85°C

DAC MCP-4822:

- 12-bit D/A Converters.
- Dout0, Dout1 General purpose Output
- SPI Interface with 20MHz Clock Support
- Fast Setting Time 0f 4.5µs
- Extended Temperature Range: -40°C to +120°C

Other Features:

- All signals of the AD-DA board can be connected to the NI KIT-51.
- SPI Communication is achieved through SPI PORT pins of NI-KIT-51 on Port P1.
- +5 V power supply from NI KIT-51 for Module.

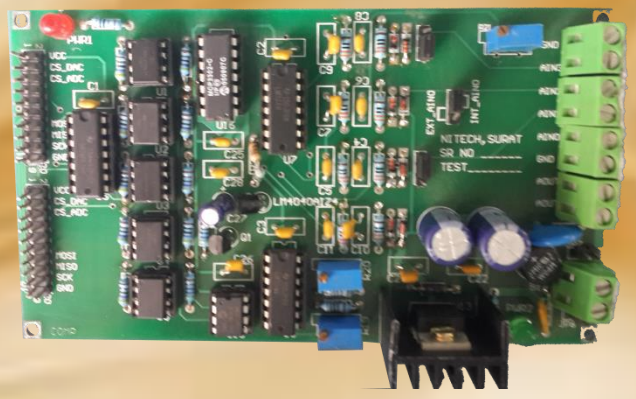
ADC-DAC Module Applications:

ADC Applications:

- Remote Sensors
- Battery Operated Systems
- Transducer Interface

DAC Applications:

- Set Point or Offset Trimming
- Sensor calibration
- Precision Selectable Voltage Reference
- Portable Instrumentation (Battery-Powered)
- Calibration of Optical Communication Devices



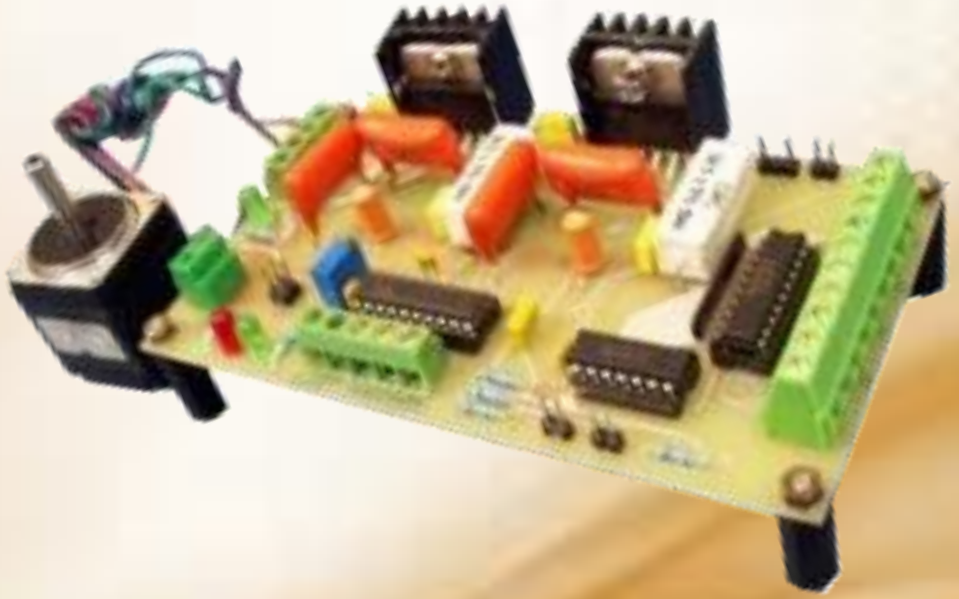
NIAC02: Stepper Motor Driver Card (with Stepper Motor)

NI SMD card is an industrial grade stepper motor drive which generates four phase drive signals for two phases bipolar and four phase unipolar step motors. The motor can be driven in half step, normal and wave drive modes and on-chip PWM chopper circuits permit switch-mode control of the current in the windings.

Key Features:

The feature of this device is that it requires only clock, direction and mode inputsignals. Since the phase are generated internally the burden on the micro-processor, and the programmer, is greatly reduced.

- Supply voltage up to 48v
- 5A max peak current (2A max. for I6201)
- Total rms current up to 4A
- RDS (on) 0.3 Ω (typical value at 25 °c)
- Cross conduction protection
- TTL compatible drive
- Operating frequency up to 100 kHz
- Thermal shutdown
- No external logic supply required
- Highlyefficient



Motor Specifications:

- Step Angle : 1.8
- Rated Voltage : 12 V
- Current/Phase: 0.4A
- Resistance/Phase : 30 ohm
- Inductance/Phase : 3.2 mH
- Holding Torque: 1.8 kg.cm
- Rotor Inertia: 20 g.cm
- No. of leads : 6

NIAC03: Single Phase Thyristor Power and Driver Card

Single phase Thyristor Firing Card basically consists of Zero Crossing Detection Circuit and pulse transformer based Thyristor gate circuit drive. Output of ZCD circuit is given to Microcontroller as input (on Interrupt pin). Microcontroller will generate two pulses which are given to Thyristor firing card as input to trigger four Thyristors. (One pulse is used for firing two Thyristors during +Ve cycle and another pulse for firing two Thyristors during -Ve cycles).

Key Features of Thyristor Firing Card:

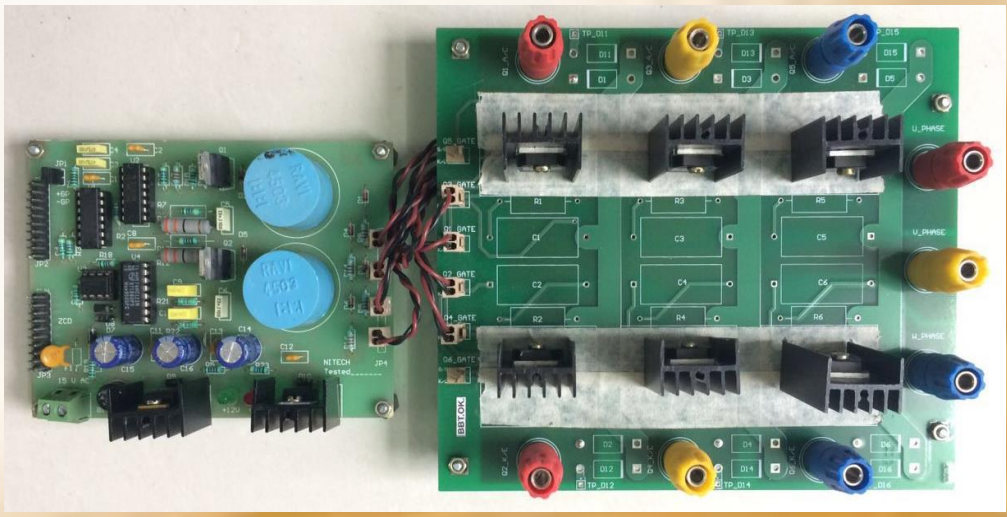
- TTL signal/gate interfacing directly to microcontroller
- Zero Crossing Detection Circuit
- Positive and Negative generation of ZCD for microcontroller interfacing
- Two pulse transformer (1:1:1)each generating two gate pulses
- Four numbers of pulse transformer based isolated Thyristor gate triggering pulses
- Onboard Carrier generator, 15 kHz Carrier Frequency Multiplication
- On board +5 V & +12V Regulated Power Supply
- Single Phase Controlled Rectifier and AC Voltage Controller is possible with this card.

Key Features of Thyristor Power Card:

Thyristor Power Card with following Specifications –

- 600 V, 5 A rating 6 Thyristors connected in three legs
- Three independent legs with top, bottom and middle point for connection
- Six connector to connect gate pulses
- Snubber circuit across device for protection
- It is possible to connect Thyristors in different power configurations like,
  - single phase half wave rectifier,
  - single phase full wave rectifier,
  - single phase AC voltage controller,
  - three phase half wave rectifier,
  - three phase full wave rectifier,
  - Three phase AC voltage controller etc.

Note: For Single phase application use only two branches of Thyristor Power card.



NIAC04: Three Phase Thyristor Power and Driver Card

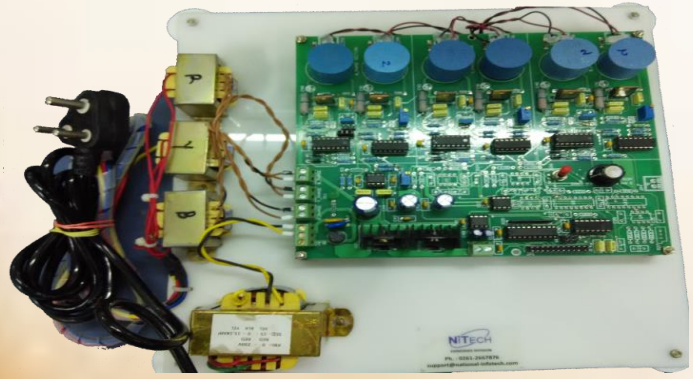
Three Phase Thyristor Firing Card:

Three Phase Thyristor Firing Card basically consists of three Zero Crossing Detection Circuit and six pulse transformer based Thyristor gate circuit drive.

Three Phase Thyristor Firing Card have two control as Analog control and Digital control as explained below:

Analog control: If switch toggle to pot indication, firing angle of Thyristors generated by firing card can be vary by pot mounted near to switch.

Digital control: If same switch toggle to DAC indication, firing angle of Thyristors generated by firing card can be vary by micro-controller card via SPI connection (Onboard SPI based DAC- mcp4822).



Key Features of Three Phase Thyristor Firing Card:

- Direct TTL logic for microcontroller interfacing
- Three phase ZCD (Zero Crossing Detection) block
- 15 kHz Carrier Frequency Multiplication
- Three individual scheme for three phase individual thyristor firing circuit
- Three numbers of phase controlled IC for generating six numbers of gate pulses
- Six numbers of pulse transformer based isolated Thyristor gate driving circuits
- Three-phase controlled rectifier and three-phase AC voltage controller is possible with this card
- Firing as well as integrated cycle control is possible
- Easy to understand scheme

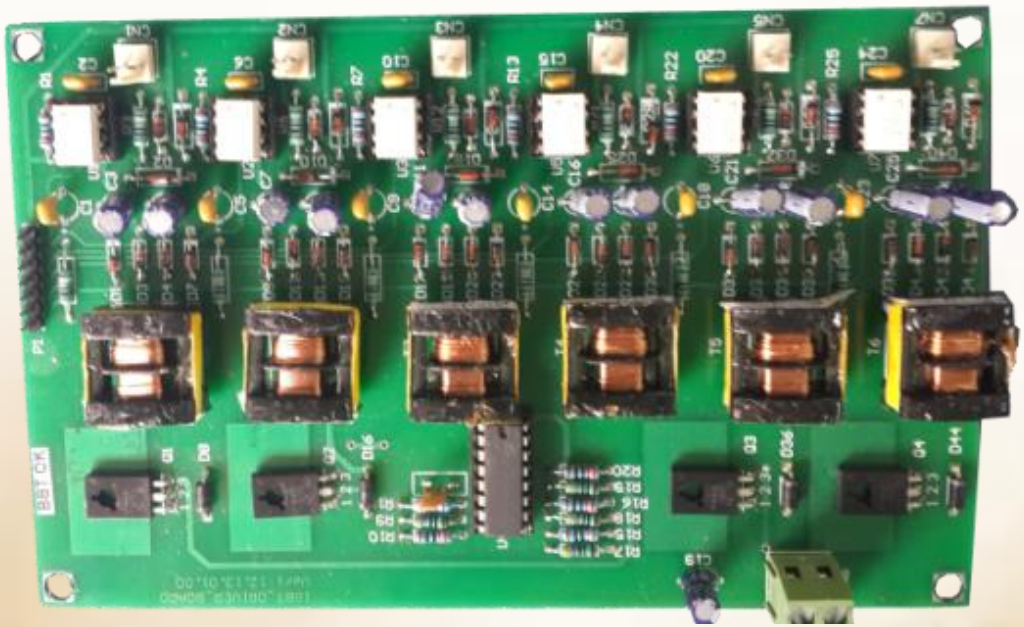
Three Phase Thyristor Power Card:

Three Phase Thyristor Power Card with following Specifications -

- 600 V, 5 A rating 6 Thyristors connected in three legs
- Three independent legs with top, bottom and middle point for connection
- Six connector to connect gate pulses
- Snubber circuit across device for protection
- It is possible to connect Thyristors in different power configurations like,
  - single phase half wave rectifier,
  - single phase full wave rectifier,
  - single phase AC voltage controller,
  - three phase half wave rectifier,
  - three phase full wave rectifier,
  - three phase AC voltage controller etc.

NIAC05: IGBT/MOSFET Driver Card

NI Driver card drives six optically isolated gate pulses. Six gate pulses generated by microcontroller is connected at input and converted into isolated six gate pulses. Bipolar output gate pulses (+15/-10 V) are generated. Six isolated power supply required for Opto isolation are provided.



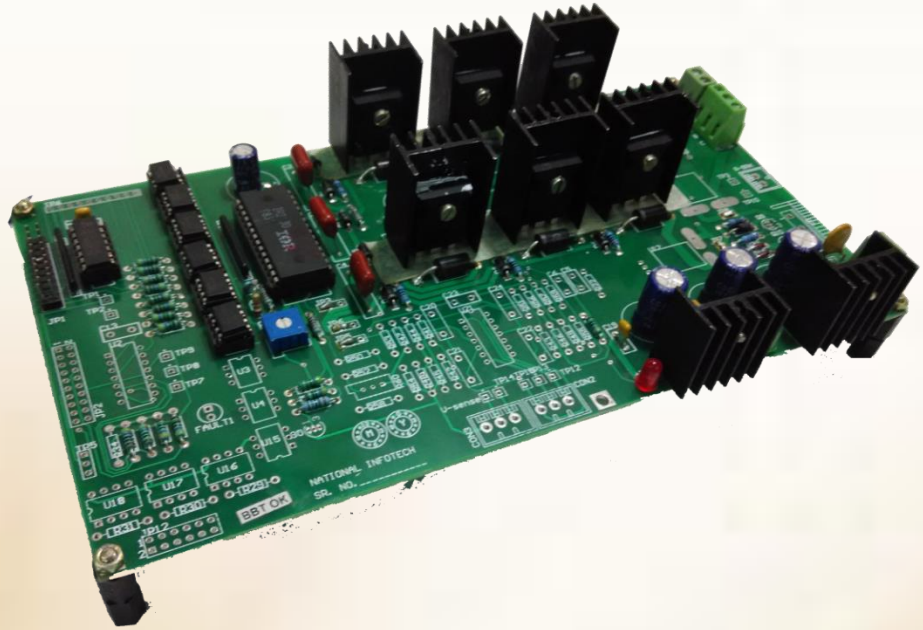
Key Features of IGBT/MOSFET Driver Card:

Driver card for isolated driving of six IGBTs

- 12 V DC input power supply
- Six no. s of microcontroller port driven gate pulse inputs
- Six no. s of optically isolated gate pulses
- Six isolated power supplies for driving optically isolated ICs
- Input pulses: CMOS 0-5 V or 0-3.3 V
- Output pulses: Isolated +16V/-8V

NIAC06: Three Phase H-Bridge Power and Driver Card

Three Phase H-Bridge Card is a ready to use hardware with six IGBTs connected in bridge configuration. Six gate pulses generated with microcontroller can be interfaced with this card. This Card can be used for designing applications like ac induction motor drive, BLDC drive or as a standalone three phase inverter. This module is designed with optical isolation between the controller card and the inverter bridge to be used for projects in power-electronics.



Key Features:

- IGBT Based Inverter Module
- Isolated Gate Drive Circuit for IGBT's
- Diode Rectifier with filter capacitor provided for AC input
- Current sensing for trip
- Encoder interfacing circuit

Specifications:

- 1200 V, 30 A rating 6 IGBTs
- Isolated gate driving for H-bridge IGBTs
- Bridge Driver IR2130 based gate driver controller
- Provision for over-current protection, provision for shaft encoder interfacing
- Induction or BLDC Motor control possible with this card
- Operation up to 300V DC

NIAC07: Three Phase Driver and Power Card with Protection

Key Features:

The distinct features of Three Phase Driver card with Protection are as following:

- Suitable for 600V / 1200V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through protection
- Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1.2 uSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.
- 06 individual Fault and Ready indications
- Possible to generate 03 complement pulses from three input pulses
- On board test points are provided for signals troubleshooting

Major Highlights of the Driver:

- Coreless transformer based isolated driver
- Galvanic Insulation
- Integrated protection features
- Suitable for operation at high ambient temperature

Typical Applications:

- AC and DC Motor Drives
- High Voltage AC/DC, DC/DC-Converter
- Power quality Converters – STATCOM, Active Filter
- Power supplies- Stabilizer
- UPS-Systems & Welding

NIAC08: Three Phase SiC MOSFET Inverter with Protection

Key Features:

The distinct features of Three Phase SIC MOSFET Inverter card with Protection are as following:

- Suitable for 600V / 1200V, 25 A SIC MOSFETs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through protection
- Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1.2 uSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.
- 06 individual Fault and Ready indications
- Possible to generate 03 complement pulses from three input pulses
- On board test points are provided for signals troubleshooting

Major Highlights of the Driver:

- Coreless transformer based isolated driver
- Galvanic Insulation
- Integrated protection features
- Suitable for operation at high ambient temperature
- Low Heat dissipation.

Typical Applications:

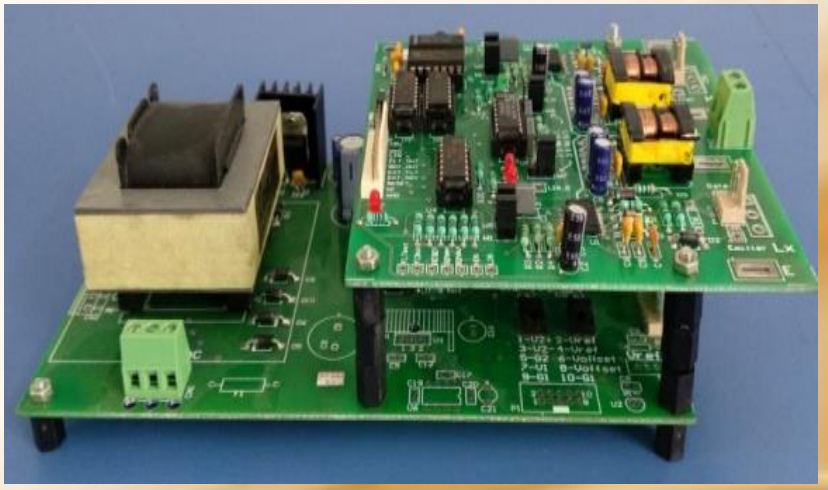
- AC and DC Motor Drives
- High Voltage AC/DC, DC/DC-Converter
- Power quality Converters – STATCOM, Active Filter
- Power supplies- Stabilizer
- UPS-Systems & Welding

NIAC09: Single Phase Compact IGBT Half-Bridge Driver and Power Card with Protection

Key Features:

The distinct features of Three Phase IGBT Half-Bridge Driver card with Protection are as following:

- Suitable for 600V / 1200V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual 2-channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through protection
- Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1.2 uSec)
- 02 individual SMPS for generating +16V/-8V isolated power supplies required for each driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.
- 02 individual Fault and Ready indications
- On board test points are provided for signals troubleshooting



Major Highlights of the Driver:

- Coreless transformer based isolated driver
- Galvanic Insulation
- Integrated protection features
- Suitable for operation at high ambient temperature

Typical Applications:

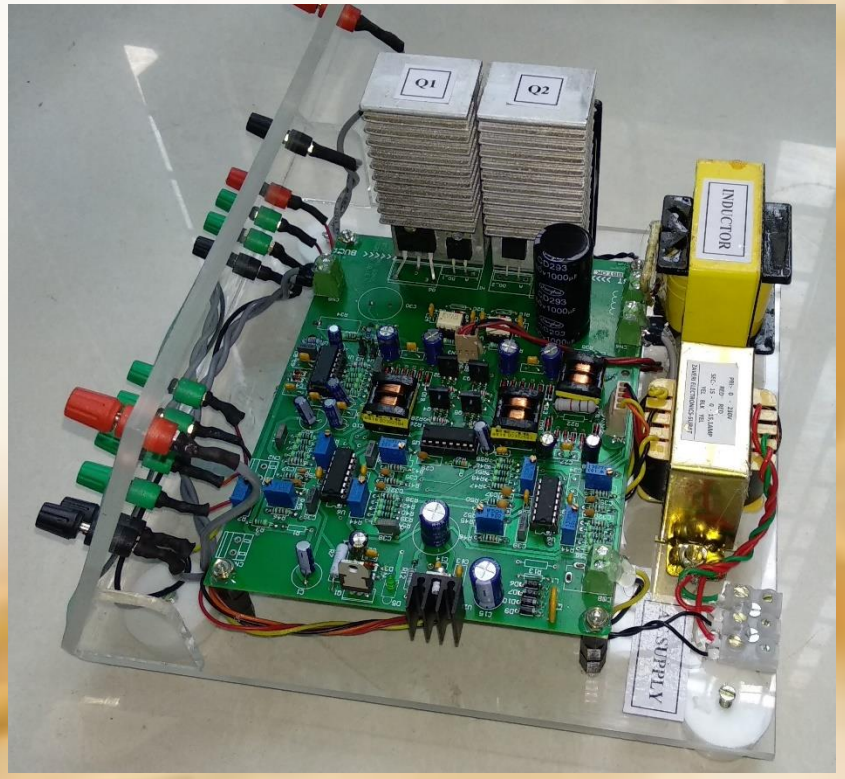
- AC and DC Motor Drives
- High Voltage AC/DC, DC/DC-Converter
- Power quality Converters – STATCOM, Active Filter
- Power supplies- Stabilizer
- UPS-Systems & Welding

NIAC10: Bidirectional DC-DC Boost Converter

Key Features:

The distinct features of Bi-directional DC-DC Converter as following:

- Power Rating: Input: 450 W, 60V, 7.5 A; Output: 150V, 3A
- Two individuals isolated IGBT driver using TLP350.
- Driver input pulses: CMOS 0-5 V or 0-3.3 V (Active low pulses)
- Onboard 03 SMPS supplies; 02 are +16V/-8V isolated power supplies requires for driver circuit and 01 is for generating +5V/-5V power supply requires for other ICs.
- On Board 10 kHz PWM generator IC with duty ratio control for open loop test.
- Sensing circuit for input voltage, input current, output voltage and output current. The sensing circuit is designed using sudo isolation technique; which allows interfacing of these four quantities to microcontroller with common reference point.
- Voltage and Current measurement specifications:
    - Non Isolated measurement
    - Voltage sensing using potential divider and differential amplifier
    - Current sensing using shunt and deferential amplifier.
    - All measurements are calibrated for 0-3V (peak-peak) output
    - Unipolar output with DC offset
    - Suitable for interfacing with unipolar ADC channel
    - Sensing circuit calibration:



Major Highlights of the Driver:

- Coreless transformer based isolated driver
- Galvanic Insulation
- Integrated protection features

Typical Applications:

- Buck Converter;
- Boost Converter;
- Battery Charge Controller;
- Solar MPPT Controller; and
- Bidirectional DC-DC Converter etc.

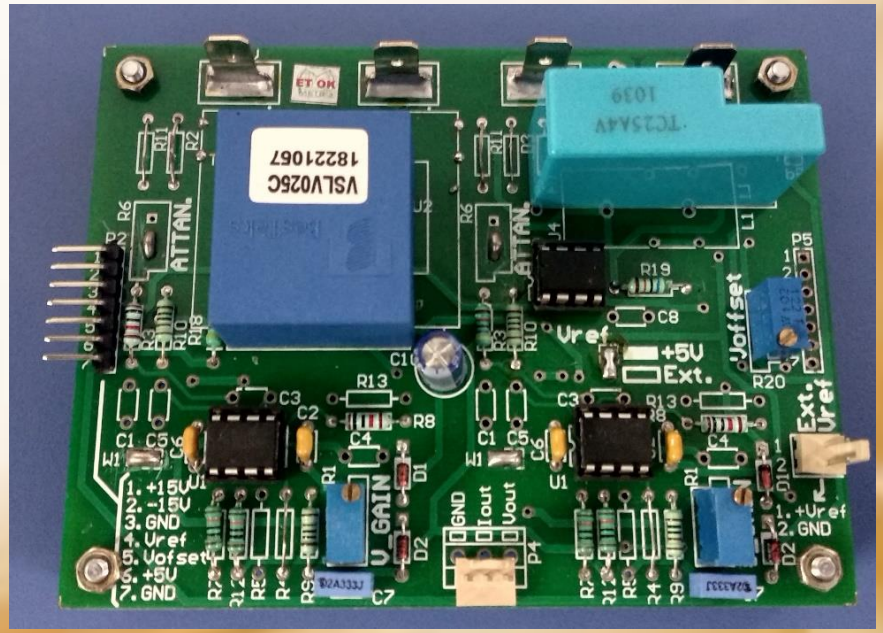
NISC01: Single Phase Sensor Card

Single Phase Sensor card is developed to sense 01 AC Voltage, 01 AC Current Signals. It is possible to add offset voltage for interfacing sensed signal with unipolar ADC, Amplitude calibration is also possible. More than Two Single Phase Sensor cards can be cascaded with each other, therefore increasing number of channels available.

Key Features of Single-Phase Sensor Card:

Single Phase Sensor card with following features:

- One AC/DC voltage measurement
  - Isolated measurement
  - One voltage sensing using Hall-Voltage Sensor
  - 0-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- One AC/DC current measurement
  - Isolated measurement
  - One current sensing using Hall-Current Sensor
  - 0-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- Auxiliary power supply and connectors for power connections.
- Two or more cards can be cascaded together with expansion connectors when necessary.
- Hall-current Sensor Specifications
  - Vout Output voltage at Ir, TA=25℃: 4V
  - Output Impedance <150 ohm
  - Load Resistor >10Kohm
  - Vcc Supply Voltage: ±15V ±5%
  - Current Consumption <20mA
  - Accuracy at Ir, TA=25℃ (without offset) <1%
  - Linearity from 0 to Ir, TA=25℃ <1%
  - Frequency Bandwidth (-3dB) 50KHz
- Hall-voltage Sensor Specifications
  - Primary Voltage Measuring Range
  - VPN(V): 10~500
  - Primary nominal rms current: 10 mA
  - Primary current, measuring range: 0~±14 mA
  - Secondary nominal rms current: 25 mA
  - Conversion ratio 2500:1000
  - Vc Supply voltage ±12~15 V, (±5%)
  - Ic Current consumption 10(@±15V) +Is mA
  - RMS voltage for AC insulation test, 50 HZ 1 min 2.5 kV
  - Creepage distance: 19.5 mm
  - Overall accuracy @IPN, TA=25℃ @±12~15V: ±0.9 %, @±15V (±5%): ±0.8 %
  - Linearity error <0.2 %



NISC02: Three Phase Sensor Card (V1)

First version of NI Sensor card is developed to sense 03 AC Voltage, 03 AC Current Signals. Also, 01 DC Current and 01 DC Voltage measurement is possible. It is possible to add offset voltage for interfacing sensed signal with unipolar ADC, Amplitude calibration is also possible. Quadrature Encoder Interface section is provided. Zero crossing detection is also provided. Hall Sensor or Encoder Interfacing for Three channels to connect either three lines of hall sensor or A-B-Z pulses of encoder is provided.

Key Features:

- AC voltage measurement
  - Isolated measurement
  - Three voltage sensing using PT (Potential Transformer)
  - Per phase 230 V, 50 Hz voltage to 0-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- AC current measurement, 0-3V unipolar output
  - Isolated measurement
  - Three current sensing using CT (Current Transformer 1200:1)
  - 5 A, 50 Hz current to 0-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- One DC voltage measurement
  - Non-isolated measurement
  - Resistive potential divider for dc voltage sensing
  - 600 V to 0-3V output
- One DC current measurement
  - Isolated measurement
  - ACS 712 hall current sensor
  - 66 to 185 mV/A output sensitivity
- Hall Sensor or Encoder interfacing
  - Three channels to connect either three lines of hall sensor or A-B-Z pulses of encoder
  - Internal pull up and wave shaping for microcontroller interfacing
- Auxiliary power supply and connectors for power connections.

NISC03: Three Phase Four Wire Sensor Card (V2)

Sensor card V2 is Modified Version of Sensor Card V1 with extra features such as Neutral Current sensing, Zero Current detection and Over Current protection Circuit. It senses 04 AC voltage and 04 AC current signals, with Offset addition and Amplitude control port. 01 DC Current and 01 DC Voltage measurement is also possible. Zero crossing detection is also provided. Hall Sensor or Encoder Interfacing to connect either three lines of hall sensor or A-B-Z pulses of encoder is provided.

Key Features:

Sensor card with following features:

- AC voltage measurement
  - Isolated measurement
  - Four voltage sensing (three phases and neutral) using PT (Potential Transformer)
  - Per phase 230 V, 50 Hz voltage to 0-3V (peak-peak) output
  - ZCD (Zero Cross Detection) of all three voltages
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- AC current measurement, 0-3V unipolar output
  - Isolated measurement
  - Four current sensing (three line current and neutral) using CT (Current Transformer 1200:1)
  - 5 A, 50 Hz current to 0-3V (peak-peak) output
  - ZCD (Zero Cross Detection) of all three sensed currents
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- One DC voltage measurement
  - Non-isolated measurement
  - Resistive potential divider for dc voltage sensing
  - 600 V to 0-3V output
- One DC current measurement
  - Isolated measurement
  - ACS 712 hall current sensor
  - 66 to 185 mV/A output sensitivity
- Speed Sensor interfacing
  - Three channels to connect three lines of hall sensor
  - Three channels to connect A-B-Z pulses of encoder
  - Internal pull up and wave shaping for microcontroller interfacing
- Comparator for over current detection.
- Auxiliary power supply and connectors for power connections.

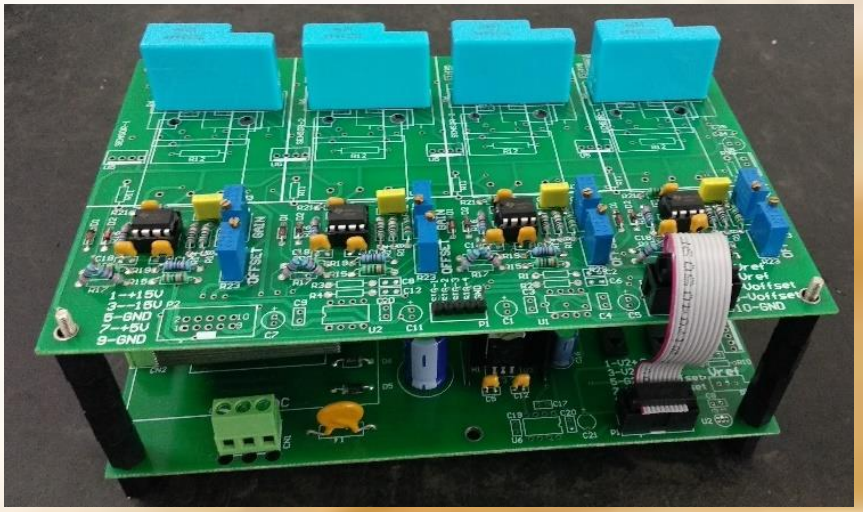
NISC04: Four Channel Hall Current Sensor Card

Four channel hall current Sensor card is developed to sense 04 AC or DC Current. It is possible to add Individual offset voltage setting for interfacing sensed signal with unipolar ADC, Amplitude calibration is also possible.

Key Features:

The distinct features of 4-Channel Current sensor card as following:

- One AC/DC current measurement
  - Isolated measurement
  - One current sensing using Hall-Current Sensor
  - 0-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- Two or more cards can be cascaded together with expansion connectors when necessary.
- Hall-current Sensor Specifications
  - Vout Output voltage at Ir, TA=25℃: 4V
  - Output Impedance <150 ohm
  - Load Resistor >10Kohm
  - Vcc Supply Voltage: ±15V ±5%
  - Current Consumption <20mA
  - Accuracy at Ir, TA=25℃ (without offset) <1%
  - Linearity from 0 to Ir, TA=25℃ <1%
  - Frequency Bandwidth (-3dB) 50KHz
- Common as well as individual offset setting
- Auxiliary power supply Board. For providing ±15 V DC, +5 V.



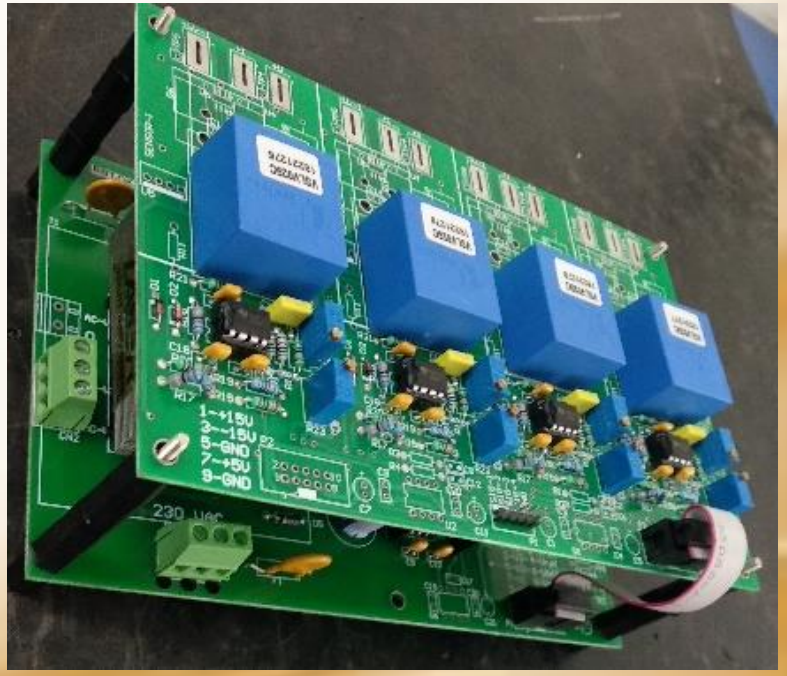
NISC05: Four Channel Hall Voltage Sensor Card

Four channel Hall Voltage Sensor card is developed to sense 04 AC or DC Voltage. It is possible to add Individual offset voltage setting for interfacing sensed signal with unipolar ADC, Amplitude calibration is also possible.

Key Features:

The distinct features of 4-Channel Current sensor card as following:

- One AC/DC Voltage measurement
  - Isolated measurement
  - One voltage sensing using Hall-Voltage Sensor
  - 00-3V (peak-peak) output
  - Unipolar output with DC offset
  - Suitable for interfacing with unipolar ADC channel
- Two or more cards can be cascaded together with expansion connectors when necessary.
- Hall-current Sensor Specifications
  - Primary Voltage Measuring Range VPN (V): 10~500
  - Primary nominal rms current: 10 mA
  - Primary current, measuring range: 0~±14 mA
  - Secondary nominal rms current: 25 mA
  - Conversion ratio 2500:1000
  - VC Supply voltage ±12~15 V, (±5%)
  - IC Current consumption 10(@±15V) +Is mA
  - RMS voltage for AC insulation test, 50 HZ 1 min 2.5 kV
  - Creepage distance: 19.5 mm
  - Overall accuracy @IPN, TA=25℃ @±12~15V: ±0.9 %, @±15V (±5%): ±0.8 %
  - Linearity error <0.2 %
- Common as well as individual offset setting
  - Auxiliary power supply Board. For providing ±15 V DC, +5 V.



NIHPM01: High Power Three Phase Rectifier and Inverter Module with Protection

High Power Three phase rectifier and inverter module with protection and sensing circuit with following Specifications –

- Maximum Input Voltage: Three Phase 415 V 50 Hz, DC Link Voltage: 600 V, Output: 400V/10 A
- 1200 V, 25 A diode bridge for AC-DC power conversion with Electrolyte DC capacitor
- Three phase 1200 V, 75 A IGBT power (SKM75GB12T4) module with appropriate heat sink and snubber circuit
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting 06 gate pulses to drive IGBTs of the inverter circuit
- IGBTs with desaturation(D-SET) protection against overload and short-circuit
- Indication of READY and FAULT with a provision to latch driver output and reset with RESET button.
- Fault output for communicating FAULT status to the Microcontroller
- Sensor Circuit: Sensing circuit for Three AC output currents, One DC current and One DC voltage
- All cards are mounted in Acrilyc box and power terminals, control terminals and sensor feedback are terminated on front panel.

The distinct features of IGBT Driver card and Sensor card are detailed below:

(i) IGBT Driver Card:

- Suitable for 600V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through, Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1 µSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.

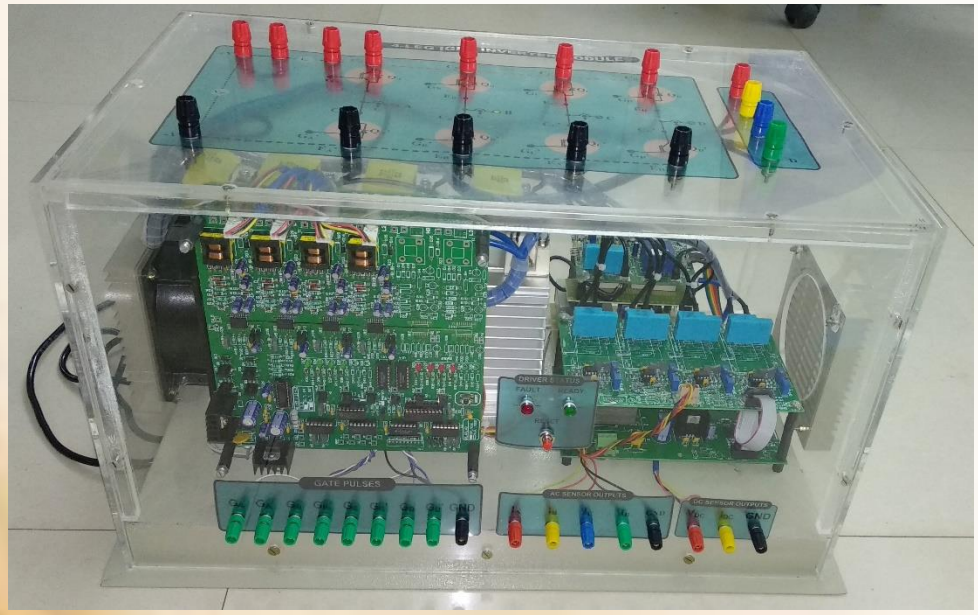
(ii) Three Phase current Sensor card

- 03 AC current measurement
- Isolated measurement
- Output restricted to 0-3V (peak-peak)
- Unipolar output with DC offset
- Suitable for interfacing with unipolar ADC channel

(iii) DC voltage current Sensor card

- One DC voltage measurement
- One DC current measurement
- Isolated measurement
- Output restricted to 0-3V below unipolar ADC reference
- Hall-current Sensor Specifications: Output voltage Vout 4V, Output Impedance <150 ohm, Load Resistor >10Kohm, Vcc Supply Voltage: ±15V ±5%, Accuracy <1%, Linearity <1% and Frequency Bandwidth 50 kHz
- Hall-voltage Sensor Specifications: Primary Voltage Measuring Range 10 - 500 V, Primary nominal rms current 10 mA, Secondary nominal rms current 25 mA, Overall accuracy ±0.9 %, Linearity error <0.2 %

NIHPM02: High Power Four Leg IGBT Inverter Module with Protection



High Power Four phase inverter module with protection and sensing circuit with following Specifications -

- Maximum Input Voltage: 600 V, 12 A DC; Maximum Output: 440V/10 A
- Four phase 1200 V, 75 A IGBT power (SKM75GB12T4) module with appropriate heat sink and snubber circuit
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting 08 gate pulses to drive IGBTs of the inverter circuit
- IGBTs with desaturation protection against overload and short-circuit
- Indication of READY and FAULT with a provision to latch driver output and reset with RESET button.
- Fault output for communicating FAULT status to the Microcontroller
- Sensor Circuit: Sensing circuit for Four AC output currents, One DC current and One DC voltage
- All cards are mounted in Acrilyc box and power terminals, control terminals and sensor feedback are terminated on front panel.

The distinct features of IGBT Driver card and Sensor card are detailed below:

(i) IGBT Driver Card:

- Suitable for 600V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through, Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1 µSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.

(ii) Four Phase current Sensor card

- 04 AC current measurement
- Isolated measurement
- Output restricted to 0-3V (peak-peak)
- Unipolar output with DC offset
- Suitable for interfacing with unipolar ADC channel

(iii) DC voltage current Sensor card

- One DC voltage measurement
- One DC current measurement
- Isolated measurement
- Output restricted to 0-3V below unipolar ADC reference
- Hall-current Sensor Specifications: Output voltage Vout 4V, Output Impedance <150 ohm, Load Resistor >10Kohm, Vcc Supply Voltage: ±15V ±5%, Accuracy <1%, Linearity <1% and Frequency Bandwidth 50 kHz
- Hall-voltage Sensor Specifications: Primary Voltage Measuring Range 10 - 500 V, Primary nominal rms current 10 mA, Secondary nominal rms current 25 mA, Overall accuracy ±0.9 %, Linearity error <0.2 %

NIHPM03: High Power Diode Clamped Multilevel Inverter Module with Protection

High Power Diode Clamped Multilevel inverter module with protection and sensing circuit with following specifications:

- Maximum Input Voltage:600 V,12A; Output: 400V/10 A
- 1200 V, 25 A diode bridge for AC-DC power conversion with Electrolyte DC capacitor
- Three phase 1200 V, 75 A IGBT power (SKM75GB12T4) module with appropriate heat sink and snubber circuit
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting 06 gate pulses to drive IGBTs of the inverter circuit
- IGBTs with desaturation protection against overload and short-circuit
- Indication of READY and FAULT with a provision to latch driver output and reset with RESET button.
- Fault output for communicating FAULT status to the Microcontroller
- Sensor Circuit: Sensing circuit for Three AC output currents, One DC current and One DC voltage
- All cards are mounted in ACRILYC box and power terminals, control terminals and sensor feedback are terminated on front panel.

The distinct features of IGBT Driver card and Sensor card are detailed below:

(i) IGBT Driver Card:

- Suitable for 600V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through, Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1 µSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.

(ii) Three Phase current Sensor card

- 03 AC current measurement
- Isolated measurement
- Output restricted to 0-3V (peak-peak)
- Unipolar output with DC offset
- Suitable for interfacing with unipolar ADC channel

(iii) DC voltage current Sensor card

- One DC voltage measurement
- One DC current measurement
- Isolated measurement
- Output restricted to 0-3V below unipolar ADC reference
- Hall-current Sensor Specifications: Output voltage Vout 4V, Output Impedance <150 ohm, Load Resistor >10Kohm, Vcc Supply Voltage: ±15V ±5%, Accuracy <1%, Linearity <1% and Frequency Bandwidth 50 kHz
- Hall-voltage Sensor Specifications: Primary Voltage Measuring Range 10 - 500 V, Primary nominal rms current 10 mA, Secondary nominal rms current 25 mA, Overall accuracy ±0.9 %, Linearity error <0.2 %

NIHPM04: SRM 4-Phase IGBT based Inverter Stack with Rectifie

SRM 4-Phase IGBT based inverter Stack with rectifier, protection and sensing circuit with following Specifications.

- Maximum Input Voltage: 0-300 V DC Output:230V/10 A
- Four phase 1200 V, 75 A IGBT power (SKM75GB12T4) module with appropriate heat sink and snubber circuit
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting gate pulses to drive IGBTs of the inverter circuit
- IGBTs with desaturation protection against overload and short-circuit
- Indication of READY and FAULT with a provision to latch driver output and reset with RESET button.
- Fault output for communicating FAULT status to the Microcontroller
- Sensor Circuit: Sensing circuit for AC output currents, One DC current and One DC voltage
- All cards are mounted in ACRILYC box and power terminals, control terminals and sensor feedback are terminated on front panel.

The distinct features of IGBT Driver card and Sensor card are detailed below:

(i) IGBT Driver Card:

- Suitable for 600V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through, Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1 µSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.

(ii) Four Phase Current Sensor card

- 04 AC current measurement
- Isolated measurement
- Output restricted to 0-3V (peak-peak)
- Unipolar output with DC offset
- Suitable for interfacing with unipolar ADC channel

(iii) DC voltage current Sensor card

- One DC voltage measurement
- One DC current measurement
- Isolated measurement
- Output restricted to 0-3V below unipolar ADC reference
- Hall-current Sensor Specifications: Output voltage Vout 4V, Output Impedance <150 ohm, Load Resistor >10Kohm, Vcc Supply Voltage: ±15V ±5%, Accuracy <1%, Linearity <1% and Frequency Bandwidth 50 kHz
- Hall-voltage Sensor Specifications: Primary Voltage Measuring Range 10 - 500 V, Primary nominal rms current 10 mA, Secondary nominal rms current 25 mA, Overall accuracy ±0.9 %, Linearity error <0.2 %

NIHPM05: SiC MOSFET based High Power Module with Rectifier

Sic-MOSFET based High Power Module with Rectifier, protection and sensing circuit with following Specifications -

- Maximum Input Voltage: Three Phase 415 V 50 Hz, DC Link Voltage: 600 V, Output: 400V/10 A
- 1200 V, 25 A diode bridge for AC-DC power conversion with Electrolyte DC capacitor
- SiC MOSFET (23 A, 900V) - CREE C3M0120090D with appropriate heat sink and snubber circuit
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting 06 gate pulses to drive IGBTs of the inverter circuit
- IGBTs with desaturation protection against overload and short-circuit
- Indication of READY and FAULT with a provision to latch driver output and reset with RESET button.
- Fault output for communicating FAULT status to the Microcontroller
- Sensor Circuit: Sensing circuit for Three AC output currents, One DC current and One DC voltage
- All cards are mounted in ACRILYC box and power terminals, control terminals and sensor feedback are terminated on front panel.

The distinct features of IGBT Driver card and Sensor card are detailed below:

(i) IGBT Driver Card:

- Suitable for 600V, 25 A IGBTs
- 2 A rail-to-rail output
- Individual six channel isolated IGBT driving
- Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse)
- Output pulses: Isolated +16V/-8V
- Shoot through, Short circuit protection with DESAT-detection
- On board hardware dead time generator circuit (1 µSec)
- 06 SMPS for generating +16V/-8V isolated power supplies required for driver IC
- Inhibiting all gate pulses during any abnormality/hardware error/FAULT condition
- RESET to start gate pulses after clearing the FAULT. Driver can be RESET via on board switch or external reset pulse.

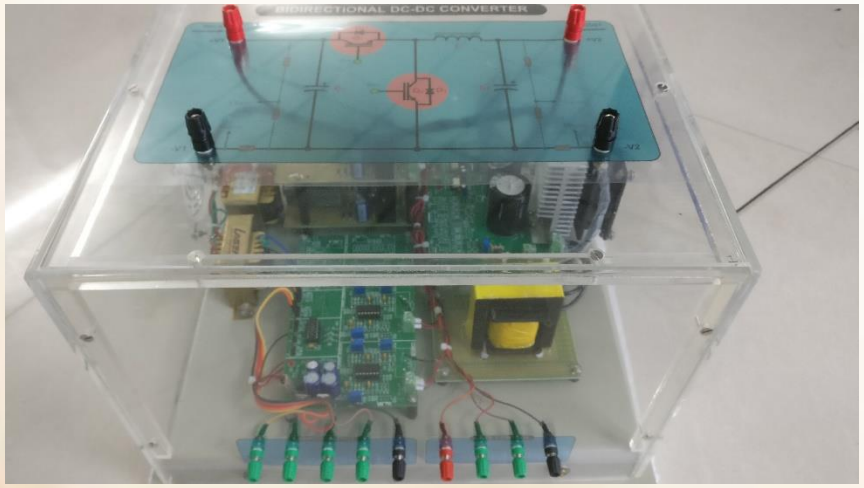
(ii) Three Phase current Sensor card

- 03 AC current measurement
- Isolated measurement
- Output restricted to 0-3V (peak-peak)
- Unipolar output with DC offset
- Suitable for interfacing with unipolar ADC channel

(iii) DC voltage current Sensor card

- One DC voltage measurement
- One DC current measurement
- Isolated measurement
- Output restricted to 0-3V below unipolar ADC reference
- Hall-current Sensor Specifications: Output voltage Vout 4V, Output Impedance <150 ohm, Load Resistor >10Kohm, Vcc Supply Voltage: ±15V ±5%, Accuracy <1%, Linearity <1% and Frequency Bandwidth 50 kHz
- Hall-voltage Sensor Specifications: Primary Voltage Measuring Range 10 - 500 V, Primary nominal rms current 10 mA, Secondary nominal rms current 25 mA, Overall accuracy ±0.9 %, Linearity error <0.2 %

NIHPM06: SiC MOSFET based 1 kW Bidirectional DC-DC Boost Converter



1 kW Bidirectional DC-DC converter for interfacing renewable sources and batteries. The unit uses SiC MOSFET as power switch and designed with protection and sensing circuit.

This Module consists of following components:

- 1 kW DC-DC Buck – Boost Converter and
- Digital Controller - ARM-cortex M4 microcontroller kit

The specifications of DC-DC Buck – Boost Converter are:

- Intelligent Power Module for DC-DC convertor
- Output Power: 1 kW Maximum
- Input Voltage: 100-200 V,
- Output Voltage: 300 V, Current: 5-10A
- Switching Frequency: 50 kHz,
- Voltage Ripple 5 %, Current Ripple 5%
- Inbuilt isolated gate driving circuits and terminal to connect gate pulse generated by controller.
- Recommended switching frequency of the inverter 20 kHz
- Port for connecting 02 gate pulses to drive IGBTs of the inverter circuit
- All cards are mounted in MS box and power terminals, control terminals and sensor feedback are terminated on front panel.
- Sensor Circuit: Input / Output DC current and DC voltage
- Output restricted to 0-3V below unipolar ADC reference

The specifications of ARM-cortex M4 microcontroller are:

- STM32F407VGT6 microcontroller featuring 32-bit ARM Cortex-M4F core, 1 MB Flash, 192 KB RAM in an LQFP100 package
- Microcontroller running at 168 MHz and providing peak throughput of 210 MIPs
- On-board ST-LINK/V2 for programming and debugging
- Board power supply: through USB bus or from an external 12V AC supply
- LIS302DL, ST MEMS motion sensor, 3-axis digital output accelerometer
- MP45DT02, ST MEMS audio sensor, Omni-directional digital microphone
- CS43L22, audio DAC with integrated class D speaker driver
- Eight LEDs: USB OTG FS with micro-AB connector
- GPIO ports are routed to header on mother board for easy connection
- All pins have 5V tolerance.

Possible experiments:

- Gate pulse generation using ARM Cortex M4 Microcontroller Kit.
- Operation of Buck Converter
- Operation of Boost Converter
- Operation as Bidirectional Converter
- Open loop and closed loop control

Typical Applications:

- Buck Converter
- Boost Converter
- Buck-Boost Converter
- Battery Chargers
- PV MPPT Chargers

NIHPM07: High Power Thyristor Module

High Power Thyristor Module to experiment around

- Single phase half-wave / full-wave controlled rectifier;
- Three phase half-wave / full-wave controlled rectifier;
- Single phase half-wave / full-wave AC voltage controller; and
- Three phase half-wave / full-wave AC voltage controller.

The detailed specifications are as following:

- Maximum Input Voltage: Three Phase 415 V, 10 A, 50 Hz
- 1200 V, 25 A Thyristors with appropriate heat sink and snubber circuit
- Three connecting terminal of each leg are given separately to form different configurations
- Port for connecting 06 gate pulses
- One uncontrolled rectifier for field circuit supply
- All cards are mounted in MS box and power terminals, control terminals and sensor feedback are terminated on front panel.

Possible experiments:

- Single phase half-wave controlled rectifier;
- Single phase full-wave controlled rectifier;
- Three phase half-wave controlled rectifier;
- Three phase full-wave controlled rectifier;
- Single phase half-wave AC voltage controller;
- Single phase full-wave AC voltage controller;
- Three phase half-wave AC voltage controller;
- Three phase full-wave AC voltage controller;
- DC Motor Drive; and
- Stator Voltage Control of Induction Motor.

Typical Applications:

- Controlled Rectifier
- DC Motor Drive
- AC Voltage Controller