



Vi Microsystems Pvt. Ltd.,

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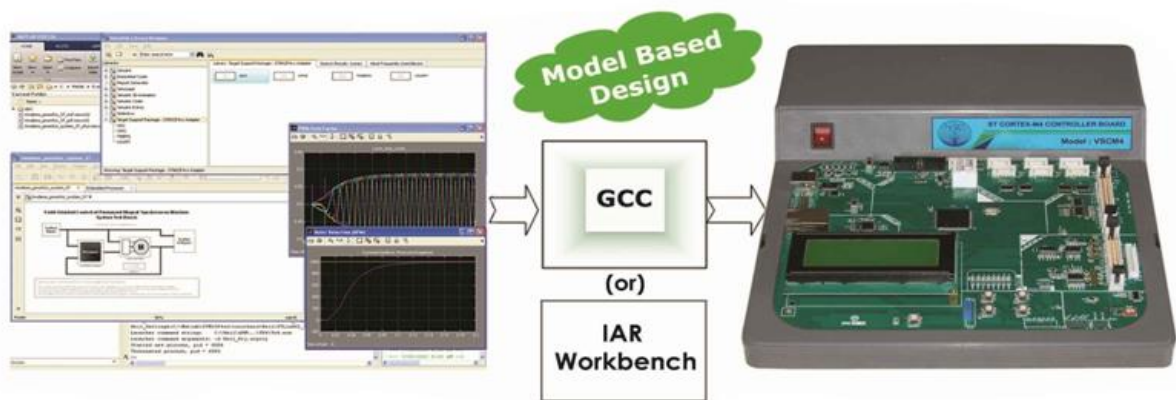
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MATLAB BASED IGBT/MIPM, SIC, GAN-DC/AC/BLDC/PMSM/SR MOTOR TRAINER

1. ST CORTEX-M4 CONTROLLER BOARD [VSCM4]



- * High performance 32bit ARM Cortex M4 (STM32F407VGT6 microcontroller).
- * Operating upto 168MHz
- * 196Kbytes of SRAM
- * 1MB On-Chip Flash
- * 8 Nos. of User LEDs & 4 Nos. of push button
- * USB to Serial Interface
- * 16x2 LCD interface

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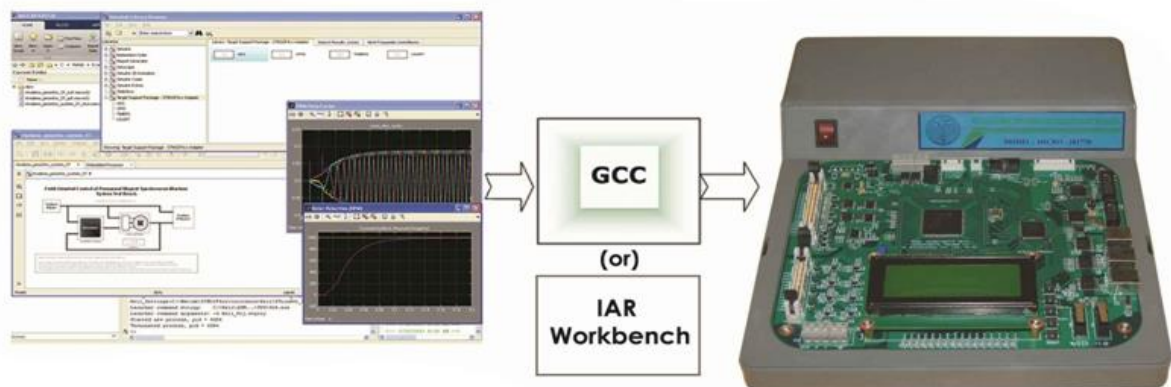
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- * 10/100Mbps Ethernet Interface
- * IPM Interface Connector
 - #16PWM Lines
 - #8 Capture lines
- * ADC Interface Connector
 - #8 Channel ADC
 - #Input range 0 to 3.3V
 - #Sampling rate : 2.4msps
 - #12 bit resolution
 - #Inputs are buffered and protected
- * 2 Channel DAC

2. DUAL CORE DELFINO DSP CONTROLLER (MICRO-28377D)



- * Processor : TMS320F28377D
- * Operating Speed : 200MHz
- * Dual Core 32 bit floating point CPU with VCU
- * Two Programmable control law Accelerators
- * On-chip 1MB of Flash
- * 34 sin PWM interface connector
 - # 16 High Resolution PWM channels

- * Matlab + Simlink Model based Design
- * Cortex M4 Controller
- * Dual Core Delfino Controller
- * Discrete IGBT and IPM

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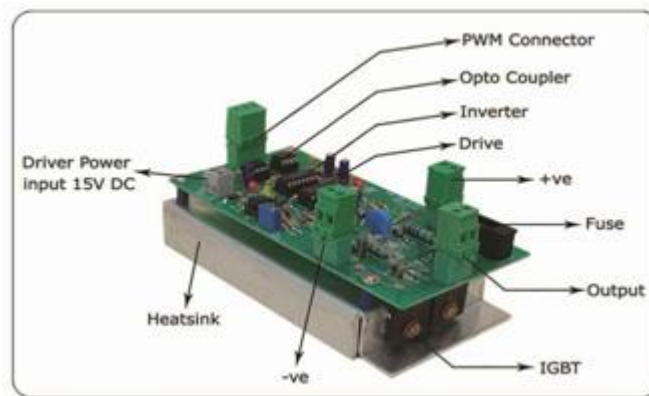
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- # 6 Nos of Enhanced capture modules
- # Quadrature Encoder Interface
- * 26 Pin ADC interface connector
 - # 12 Channel single ended ADC
 - Resolution : 12 bit, - Sampling rate : 3.5 MSPS
 - # 2 Channel Differential input ADC
 - Resolution : 16 bit, - Sampling rate : 1.1 MSPS
- * Three 12 bit Buffered DAC outputs terminated at J801 connector.
- * 2Nos of switches & 4Nos of LEDs for user Interface
- * Opto Isolated USB interface for PC communication
- * Onboard Opto Isolated USB to JTAG Emulator.

3. Dual IGBT Module (VID-04)



- * Two number of IGBT with snubber circuit & heat sink provided for power circuit to form one Leg.
- * One number of IR2112 driver IC used for IGBT driver with opto isolation
- * On-Board Protections
 - # Heat Sink provided to mount the 2 IGBTs for avoiding over temperature
 - # Over current sensing and protection with fuse provision
 - # Over current protection pulse by pulse
 - # dv/dt Protection using snubber
- * One 2 pin Screw type phoenix connector for 2 center point of Half bridge
- * 2 Nos of 2 pin screw type phoenix connectors for connecting DC link voltage +V & -V.
- * One 3 pin screw type phoenix connector for 2 PWMS from the controller
 - # PWM inputs : 0-5V/0-3V level, **opto Isolated**
 - # Power input : DC Link Voltage : Upto +350 Volt DC.

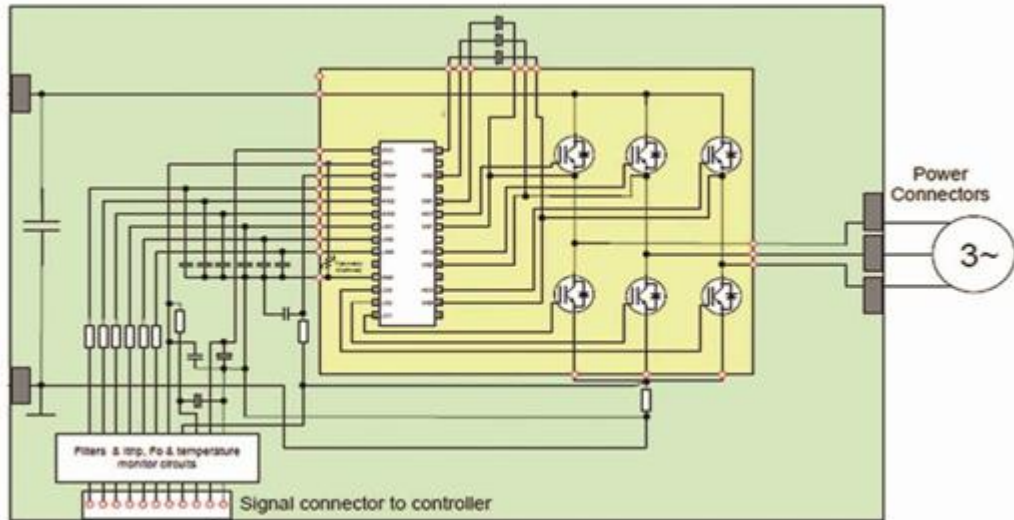
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4. Mini IGBT IPM based Power Module (Vid-O4Cipos)



- * CIPOS Mini Smallest IPM Provided with Protection Embedded Inside
- * PWM Input 3.3V/5V Inputs with hysteresis
- * Short Circuit Protection/Under Voltage Protection
- * Built in Temperature Sensor
- * IPM@20A, 600V, 3Phase

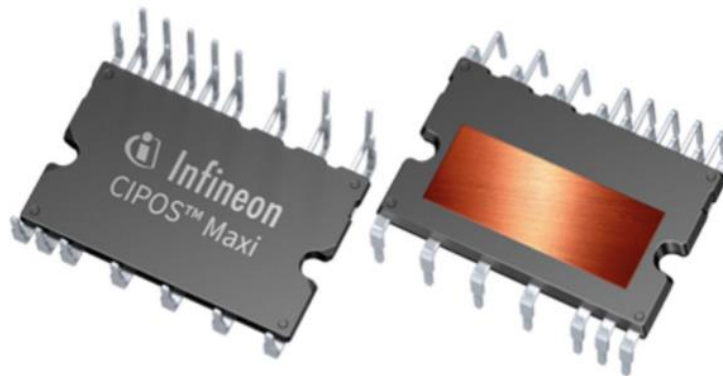
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- * Integrated control IC for gate Driving
- * Can directly connect to a PWM controller
- * Power Input : DC Link Voltage upto 350V DC
- * Power Output : 230V, AC, SAp.
- * IPM Protections
 - # Short Circuit Protection/Under it voltage. Protection.
 - # Smart Shutdown.
 - # Over Temperature
 - # Over Voltage & Over Current
 - # Bootstrap Circuit
 - # Suppresses short pulses for false IGBT Driving
 - # Input noise Filter
 - # Comparator for Fault Protection



5. Dual SIC Device Module



- * Consists of 2 SIC MOSFET with Driver
- * In-built Isolated Power Supply
- * 1200V/12A Peak voltage circuit device

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- * Switching Speed upto 1MHz
- * Normal frequency upto 500KHz
- * On-Board Protections
 - # Heat Sink provided to avoid over temperature
 - # Over current sensing and protection with fuse provision
 - # Over current protection pulse by pulse
 - # dv/dt Protection using snubber
- * One 2 pin Screw type phoenix connector for 2 center point of Half bridge
- * 2 Nos of 2 pin screw type phoenix connectors for connecting DC link voltage +V & -V.
- * One 3 pin screw type phoenix connector for 2 PWMS from the controller
 - # PWM inputs: 0-5V/0-3V level, **opto Isolated**
 - # Power input: DC Link Voltage: Upto +350 Volt DC.

6. Dual GaN Device Module

- * 650V/30A peak GaN device based power module
- * Dual GaN device forms Half Bridge of power Module
- * High Speed opto driver inbuilt
- * I/P, O/P connectors provided
- * Max Operating Voltage: 325V
- * Max Operating Current: 5A
- * Max Operating Frequency: > 100KHz

7. Mini SiC MOSFET BASED IPM POWER MODULE

As SiC MOSFET is preferred over IGBT for its advantage like higher switching frequency, best in class switching and conduction losses, increased power density, smaller Magnetic filter component, Reduced Cooling Requirements etc, makes this power device an ideal choice for power electronic, motor drives, solar invertors for renewable energy and many more applications.

This resulted in a need for the introduction of SiC MOSFET based Power Module for students' experimentations

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This power module can be used along with a Various PWM controller to drive DC, AC INDUCTION, BLDC motor and PMSM Motor.

A monolithic single control IC for all 6 MOSFETs provides further advantages, such as bootstrap circuitry, matched propagation delay times, built-in dead time, anti cross conduction, and all 6 MOSFETs turn-off under fault situations like under voltage lockout or over current.

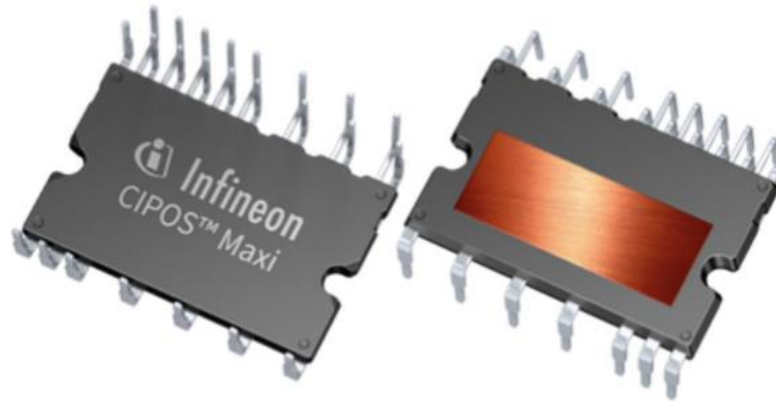
- * This Mini Intelligent Power Module consists of 6 Nos of Power SiC MOSFET
- * 6 Nos of freewheeling diodes.
- * 1 no of power SiC MOSFET and diode for over voltage braking with braking resistor.
- * Rating of device is 1200V@ 20AMP
- * Isolated +15 Vdc@1amp provided for control ic's
- * One number of Single phase diode rectifier (1200V, 35Amp) with filter capacitor provided for input ac rectification and for power circuit input with fuse protection
- * 7 Nos of high speed OPTOcoupler with driver provided for providing galvanic isolation between power switches and DSP controller .
- * 6 Nos of patching plugs provided to select the two different configuration of power module either BLDC Drive or SR Drive.
- * Two nos of socket provided for Interface speed and position sensor from BLDC.
- * 3 nos of Jumper plugs provided to connect the sensor.
- * As suggested by Manufacturer, 65KHZ switching frequency preferred
- * Various Experiments on 65KHZ SiC MOSFET & DSP Controller will be good exposure for students.

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*** POWER RATING**

Input – 350V DCV max

Output – 10A max

Protection

Over current protection

Output Voltage protection

Short circuit protection

Over temperature protection

Over current shutdown

Under-voltage lockout at all channels

All of 6 switches turn off during protection

All are fixed on a open platform for students hands-on visualization & experimentation.

Connectors provided to interface a DSP/ARM/FPGA Controller.

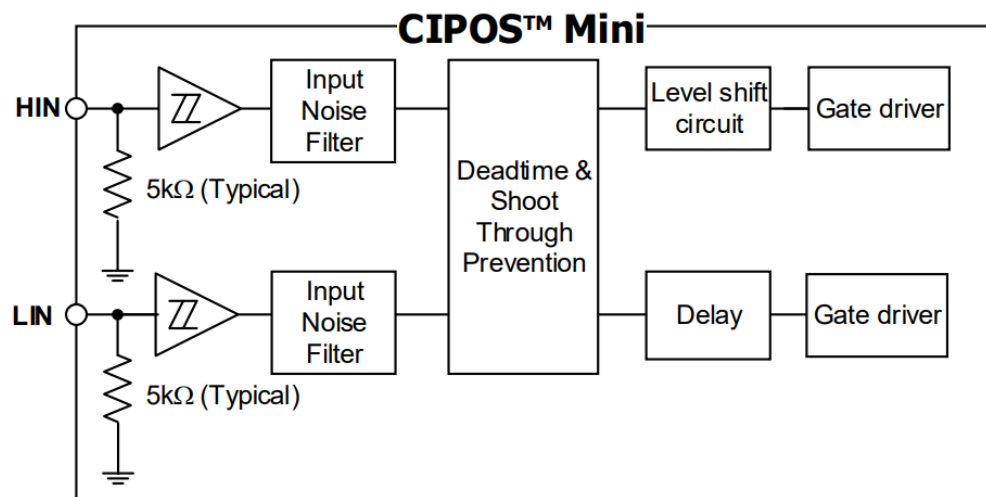


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8. SiC MOSFET BASED CONFIGURABLE POWER MODULE

As SiC MOSFET is preferred over IGBT for its advantage like higher switching frequency, best in class switching and conduction losses, increased power density, smaller magnetic filter component, Reduced Cooling Requirements etc, makes this power device an ideal choice for power electronic, Motor drives, solar invertors for renewable energy and many more applications.

This resulted in a need for the introduction of SiC MOSFET based Power Module for students Experimentations

This power module can be used along with a DSP controller to drive DC, AC INDUCTION, BLDC motor, PMSM or SR MOTOR. The configuration is done by simply change Plugs .as all motors can be driven by one configuration. For SR Motor, the configuration has to be changed by Patching Plugs

- *This power module consists of 6 Nos of PowerSiC MOSFET
- *6 Nos of freewheeling diodes. And
- * 1 no of powerSiC MOSFET and diode for over voltage braking with breaking resistor.
- *7 Nos of high speed OPTO coupler with driver provided for providing galvanic isolation between power switches and DSP controller .
- *6 Nos of patching plugs provided to select the two different configuration of power module either BLDC Drive or SR Drive.
- *Two nos of socket provided for Interface speed and position sensor from BLDC and SR Motor.
- *3 nos of Jumper plugs provided to connect the sensor.
- * As suggested by Manufacturer, 65KHZ switching frequency preferred
- * Various Experiments on 6SKHZ SiC MOSFET & DSP Controller will be good exposure For students.

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* POWER Rating

Input — 350V DCV max

Output — 10A max

* Protection

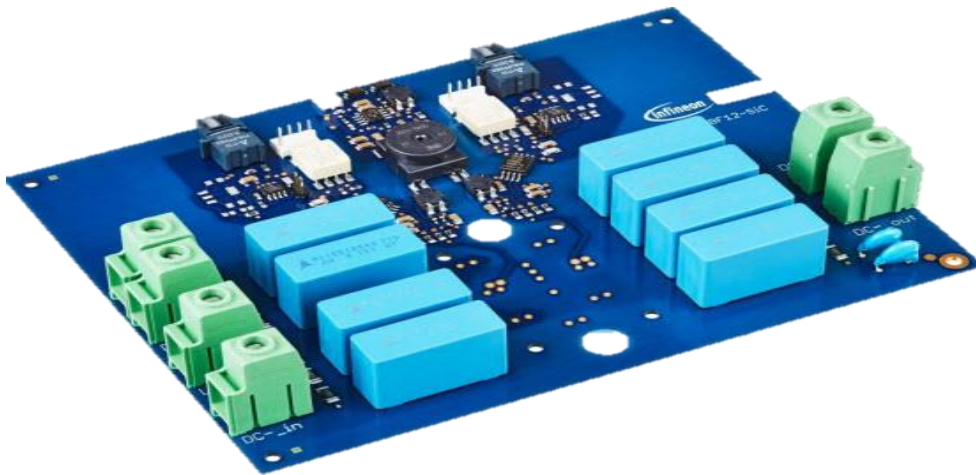
Over current protection

Output Voltage protection

Short circuit protection

Over temperature protection

- All are fixed on an open platform for students hands-on visualization & experimentation.
- Connectors provided to interface a DSP controller.



9. CURRENT/ VOLTAGE/ SPEED SENSOR MODULE

(Vid-04ivs)

- 2 Hall Effect Current Sensors to measure the AC/DC Current Lines
- 2 Hall Effect Voltage Sensors to measure the AC/DC Voltage Lines
- Signal Conditioner for each sensors : Output : 0 - 3.3 V AC or DC
- Terminated at Connector for interfacing with the DSP / FPGA controller
- If 2 Boards are purchased, the student can measure

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- i. 3nos of AC Voltages of the 3 Phase Inverter
- ii. 1no of DC - LINK Voltage of the 3 Phase Inverter
- iii. 3nos of AC Currents of the 3 Phase Inverter
- iv. 1no of DC Current of the DC - LINK Line
- Signal Conditioner for Speed Sensor



10. DC Voltage Source Choice of Power Device

This unit is used to feed DC Link Voltage to H-Bridge & IPM and provides the driver supply.

- * Variable DC Voltage 10V to 325V/1A
- * Fixed DC Voltage 325V/5A
- * Fixed DC Voltage 15V/500mA
- * Input 230V AC
- * DPM provided to display the output voltage
- * Outputs are taken through Banana connector

Choice of Power Device

- * IGBT
- * IPM
- * SiC
- * GaN

For Research Work

11. DC, AC, BLDC, SR & PMSM Motor Setup

- * 3 ϕ AC, 100W Squirrel cage induction motor

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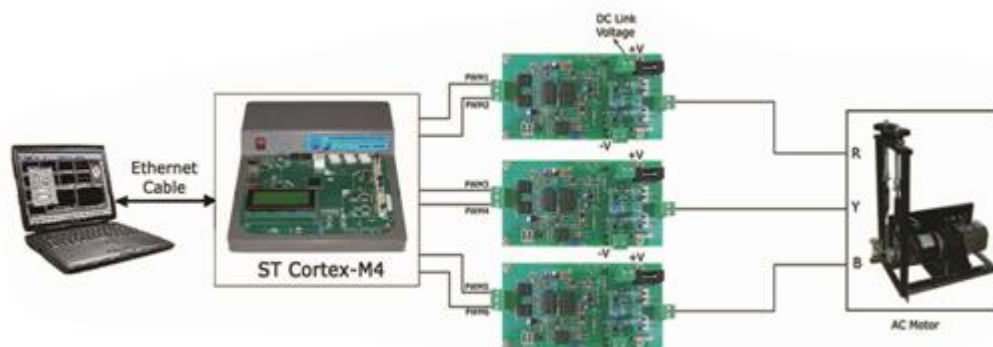
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- * 50V/2A PMDC Motor
- * 24V BLDC Motor
- * 400W, 220V PMSM Motor
- * Each motor is loaded by mechanical spring balance setup
- * Speed sensing arrangement provided in the shaft



FEW APPLICATIONS

a. 3 Phase AC Induction Motor using 3 Half Bridge



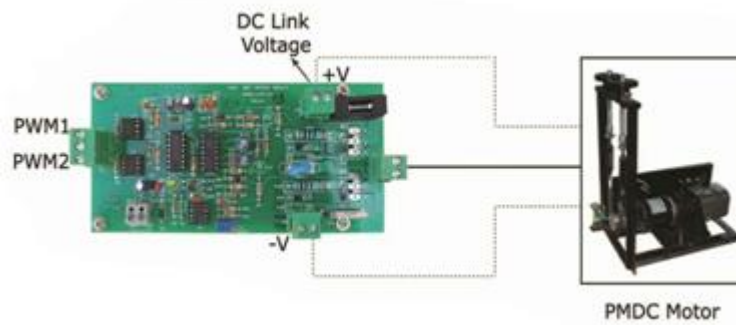
b. PMDC Motor 1 - Quadrant Operation

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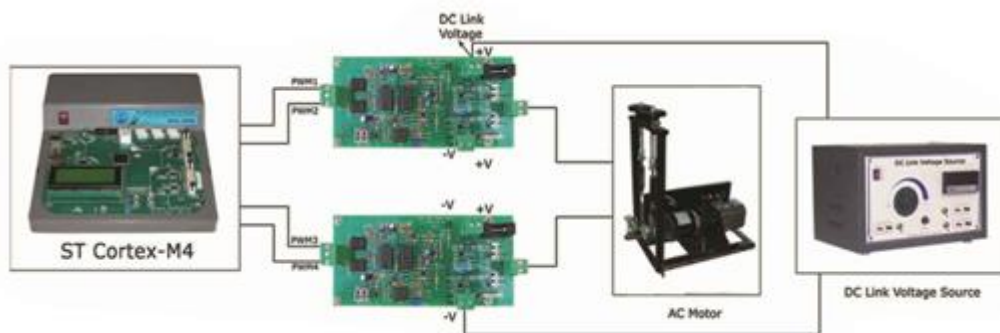
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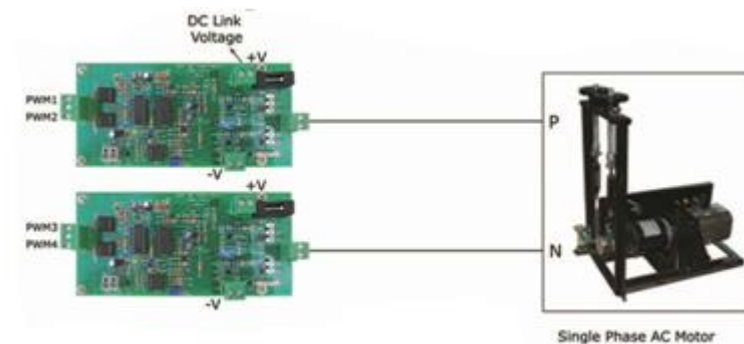


c. PMDC Motor 4- Quadrant Operation

* Uni - Polar Operation * Bi-Polar Operation 2 Half Bridge



d. Single Phase Inverter by using



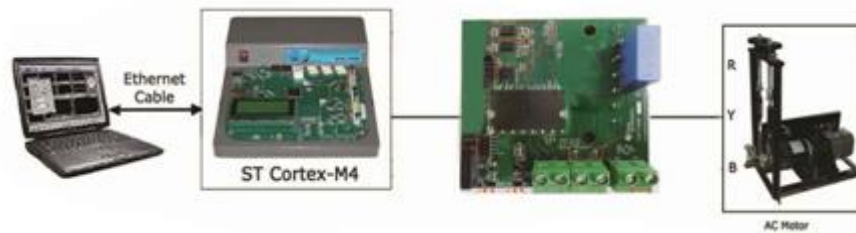
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3 ϕ AC Induction Motor Drive using CIPOS IPM



3 ϕ AC Induction Motor Drive using SILLIMM IPM



ARDUINO COMPATIBLE PWM CONTROLLERS

12. RP2040 Dual Core Based PWM Controller.

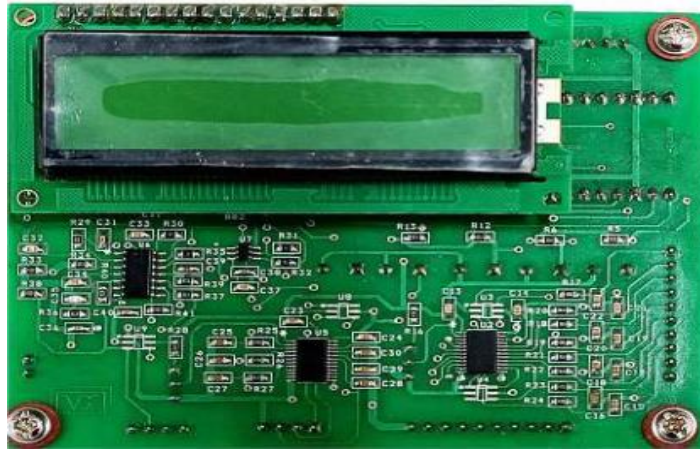
As Raspberry based embedded Controllers become more and more awareness among students, Vi Micro has designed another innovative PWM Controller, based on Raspberry RP2040 Processor, which provides Dual Core Cortex M0+ Microcontroller, 16 PWMs, ADC, etc, to build many Power Electronics Applications.

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The **RP2040 Dual Core** Processor is used to build this PWM Controller, which consists of Dual Core Cortex M0+ Microcontroller with Flash Ram, PWM, ADC and many on board features.

Features:

- Based on Raspberry RP2040 Dual Core Cortex M0+ MCU
- Digital I/O Pins: 22 headers
- UART, SPI, I2C
- Memory: Flash :2 MB, SDRAM: 264KB
- Clock Speed: up to 133 MHz
- Microcontroller: Dual Core Cortex-M0+ 32bit ARM MCU
- Digital I/O Pins: 8 nos.
- PWM Pins: 6nos.
- Analog Inputs: 6no, 12bit

Carrier Board Features:

- 3-nos of Analog Inputs are terminated at P2 connector
- 12bits, 350Ksps

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- 1-no of Digital to Analog is terminated at P5 connector
- 6 PWM Signals terminated at P3 connector.
- 3-nos of Capture are terminated at P4 connector for Proximity sensor and Quadrature Encoder Sensor interfacing.
- Buffer Provider for the PWM and Capture signals
- RS232 - Com Port interface with PC
- 20X4 Alphanumeric LCD Display
- 4 Push Button switches for user applications and its expansion available in P8 connector.
- PMOD connector provided for Hardware expansion.

13. ARDUINO Based FPGA CYCLONE 10 PWM Controller.

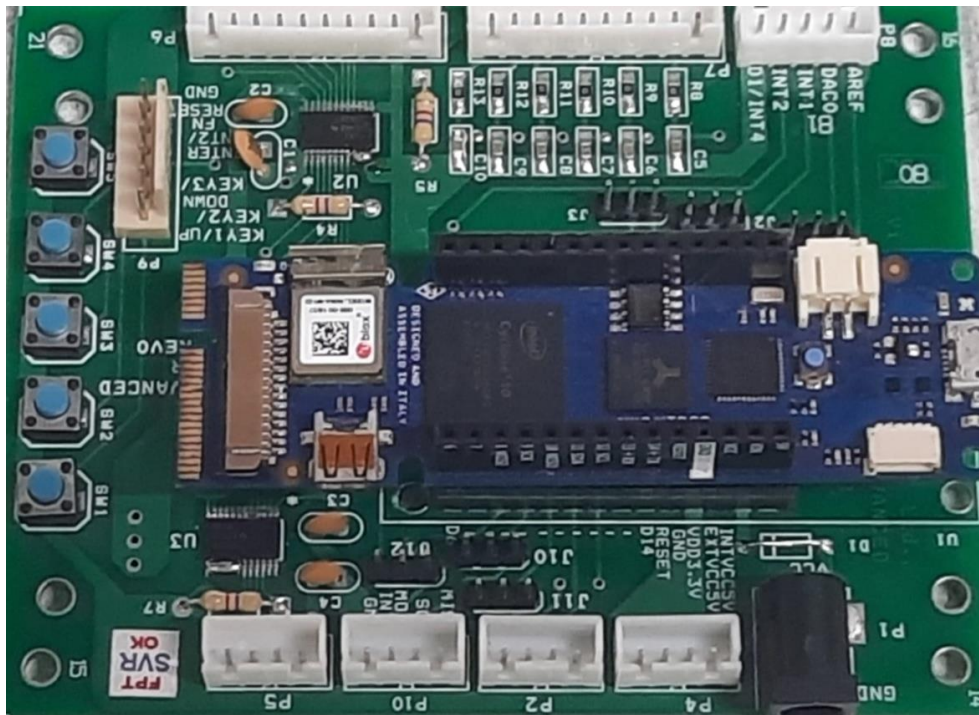
As Arduino based embedded Controller become more awareness among students, Vi Micro has designed another innovative PWM Controller based on Arduino Vidor 4000 Controller, which provide a Cortex M0+ Microcontroller and a Cyclone 10 FPGA to build many Power Electronics Applications.

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The Arduino Vidor 4000 is used to build this PWM Controller, which consists of one Cortex M0+ Microcontroller and Intel Cyclone10 FPGA.

Features:

- Based on Arduino Vidor with FPGA & Cortex M0
- FPGA: Intel Cyclone 10CL016
- Digital I/O Pins: 22 headers + 25 Mini PCI Express
- UART, SPI, I2C
- Memory: Flash :2 MB, SDRAM: 8MB
- Clock Speed: 48 MHz - up to 200 MHz
- Microcontroller: Cortex-M0+ 32bit ARM MCU
- Digital I/O Pins: 8 nos.
- PWM Pins: 6 nos.
- Memory: Flash: 256KB, SDRAM: 32KB
- Analog Inputs: 6 no, 12bit
- Analog Outputs: 1 no, 10bit
- Clock Speed: 48MHz

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Carrier Board Features:

- 6-nos of Analog Inputs are terminated at P2 connector
- 12bits, 350Ksps
- 1-no of Digital to Analog is terminated at P5 connector
- 6 PWM signals terminated at P3 connector.
- 3-nos of Capture are terminated at P4 connector for sensor interfacing.
- Buffer Provider for the PWM and Capture signals
- RS232 - Com Port interface with PC
- 20X4 Alphanumeric LCD Display
- 4 Push Button switches for user applications and its expansion available in P8 connector.

14. TMS320F28049 DSP Based PWM Controller.

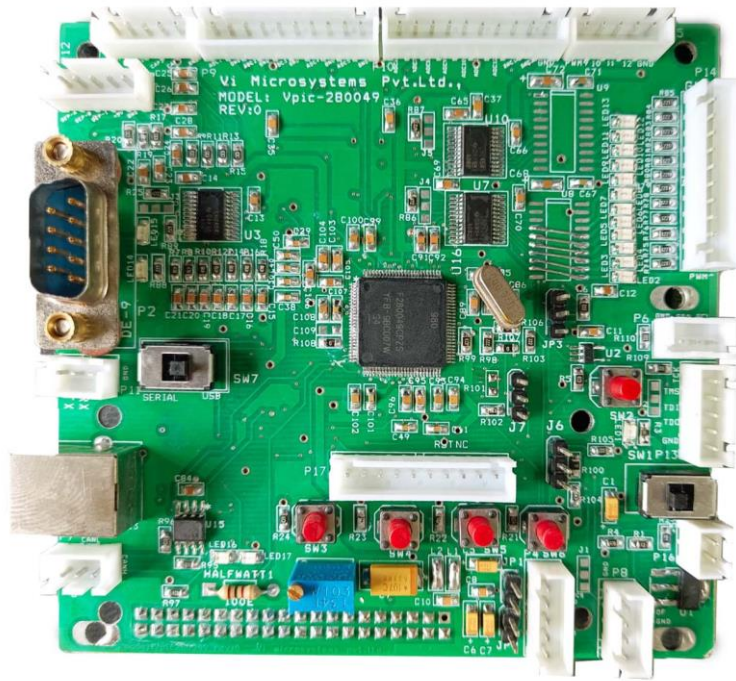
As DSP based Controllers become more and more awareness among students, Vi Micro has designed another innovative PWM Controller, based on Texas Instrument TMS320F28049 Processor, which provides 32Bit F2812 DSP Core , 16 PWMs, fast ADC, Specialised Peripherals Like CLA, ADC, etc, to build many Power Electronics Applications.

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Hardware Features

- [TMS320F280049C](#): 100 MHz C28x CPU with FPU and TMU, 256 KB Flash,
- 3x 12-bit ADC, CAN, encoder, FSI, UART, and more
- Programmable Control Law Accelerator (CLA)
- 3.45-MSPS, 12-bit Analog-to-Digital Converters
- Power domain isolation for real-time debug and flash programming
- CAN transceiver
- Two encoder interface connectors
- 3-nos of Analog Inputs are terminated at P2 connector
- 1-no of Digital to Analog is terminated at P5 connector

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