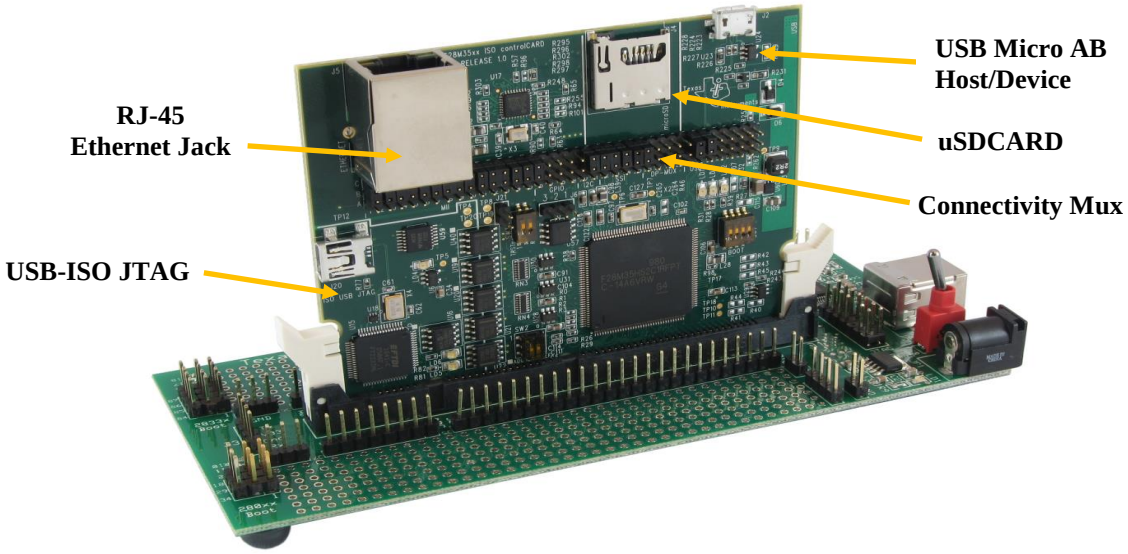
TMS320F28M35xx Concerto controlCARD R1.0 Information Guide

C2000 Systems and Applications Team



Texas Instrument's **Concerto F28M35xx controlCARD** can be used as a quick evaluation board with control, connectivity signals and ports to F28M35xx MCU.

1. The controlCARD features: Rev1.0:

- Small size – 90mm x 70mm (3.5" x 2.8")
- DIMM100 compatible cards for C2000 system application boards
- Isolated XDS100 V2 JTAG port for easy interface to Code composer 4.2.x
- Connectivity mux connector allows easy interface to connectivity ports on the top of the controlCARD and to the legacy DIMM compatible signals at the bottom
- Rev1.0 controlCARD runs on the TI controlCARD docking station. Use 5V input supply on the docking station to power 3.3V regulator on the the controlCARD
- Supports EMAC, USB host/device, SDmicro card and serial comms
- GPIO, ADC and other key signals routed to gold connector fingers
- Clamping diode protection at ADC input pins
- Isolated RS-232 communication

NOTE: this kit is designed to be a kit to explore the functionality of the F28M35 microcontroller. Even though the controlCARD can be treated as a good reference design, it is not intended to be a complete customer design. Full compliance to safety, EMI/EMC, and other regulations are left to the designer of the final customer's system.

2. Errata

2.1 Warnings/Notes/Errata

1. **Apply extra caution when using R1.0 controlCARDs in high voltage situations.**
   R1.0 controlCARDs may have an incorrect capacitor between the isolated sections (refer to C276 in the controlCARD schematic). Remove this capacitor while emulating in high voltage environments (i.e. >10V). This capacitor has been removed by default on controlCARDs shipped since November 2011.
2. **J2 is not an isolated USB port.** Apply extra caution when connecting external USB devices while this card is plugged in high power application boards. Always use an external USB isolation buffer when debugging high power systems.
3. The docking station JTAG port is not connected by default. It can be enabled by populating R40 through R46. Note that the ISO JTAG port and the docking station JTAG port should not be used simultaneously.
4. R311 is not populated to enable the TX_ER signal by default. This causes one of the RJ45 LEDs not to toggle during EMAC activity. Placing a pull-up on this pin will make the LED work properly.
5. Connectivity Mux ABC jumper position 5 shares the BOOT mode pin (GPIO43). Connectivity Mux ABC jumper position 5 should be removed for a reliable read of GPIO43 during boot mode selection. Note that GPIO43 status does not limit *boot_ to_ flash* mode. Refer to Table 6-16 in the F28M35 datasheet (SPRS742I) for more information on device boot modes.
6. The controlCARD ADC input capacitors do not have the preferred value of 3.3nF. See C91, C85, C99, C117, C79, C94, C104, C100, C96, C93, C92, and C110 in the schematic. This will impact ADC conversion and results. These have been replaced on controlCARDs shipped since October 2011.
7. X2.2, X2.4, C264.2, C265.2, and U32.94 make up a signal net which contains a clean ground for maintaining proper clock generation. Current controlCARD schematics show these terminals additionally tied to the system ground. This is incorrect. The terminals should only be tied directly together as stated in the device datasheet.
8. In the “Reset Circuitry” block of the schematic, R26 and C111 should not be populated in future designs in order to align with datasheet specifications. Refer to sheet 2 of the F28M35x controlCARD (R1.0) schematic.

3. Hardware package

Each controlCARD includes a "*Hardware Developer's Package,*" and a set of "*soft collateral*" files which makes deploying this technology very easy.
These files include:

- Schematics
- Bill of materials (BOM)
- Gerber files

3.1 Experimentation Software

All software for the TMS320F28M35xx family of MCUs can be found within controlSUITE (http://www.ti.com/controlsuite). Once installed the key examples can be found at:

\controlSUITE\device_support\f28m35x\

This example software includes many projects that allow the user to experiment with the ADC, PWM, and many other C2000 peripherals.

4. References

Isolated JTAG – ISO JTAG:

J20	USB_A connector is intended for XDS100V2 JTAG emulation and SCI communication through dedicated FTDI logic

Connectivity ports/Jumpers:

J2	USB micro AB connector supports USB 2.0 host/device
J4	SD Micro card adaptor through SPI port
J5	Ethernet port
J6	EEPROM write protect. Jumpers on pins 1-2 connects WP pin to 3.3V (protected). Jumpers on pins 2-3 connects WP pin to GND (not protected)
J21	Default unconnected. Connected if isolated EMU0 signal is needed for JTAG.

LEDs:

LD1	Turns on when controlCARD is powered on (Green)
LD2	Controlled by PC6_GPIO71 (Red)
LD3	Controlled by PC7_GPIO70 (Red)
LD4	Power for ISO JTAG logic (Green)
LD5	UART/SCI Rx activity indicator
LD6	UART/SCI Tx activity indicator

SW1: Controls the boot mode options of the F28M35xx device

M3 boot Mode	C28x boot Mode	PG2_GPIO34	PG3_GPIO35	PG7_GPIO47	PF3_GPIO43
Boot from Parallel IOs	Boot from Master	X	0	0	0
Boot from M3 RAM	Boot from M3	X	0	0	1
Boot from M3 serial peripherals (UART0/SSI0/I2C0)	Boot from M3	X	0	1	0
Boot from M3 CAN	Boot from M3	X	0	1	1
Boot from M3 Ethernet	Boot from M3	X	1	0	0
Boot from M3 Flash	Boot from Master	X	1	1	1

SW2: ADC VREF control

The ADC reference will range from 0 to 3.3V by default. However, if the ADC in the ADC registers is configured to use external limits, the ADC will convert its full range of resolution from VREF-LO to VREF-HI.

Position1 - Controls VREF-HI, the value that the ratio-metric ADC will convert as the maximum 12-bit value, which is 0x0FFF. In the downward position, VREF-HI will be connected to 3.3V. In the upward position, VREF-HI will be connected to pin 66 of the DIMM100-socket. This would allow a connecting board to control the ADC VREF-HI value. This extends VREF-HI connections to both the ADCs on the F28M35xx device.

Position 2 - Controls VREF-LO, the value that the ratio-metric ADC will convert as the minimum 12-bit value, which is 0x0000. In the downward position, VREF-LO will be connected to 0V. In the upward position, VREF-LO will be connected to pin 16 of the DIMM100-socket. This would allow a connecting board to control the ADC-VREFLO value. This extends VREF-LO connections to both the ADCs on the F28M35xx device.

SW3: TRST/ ISO SCI communication signal enables

Position 1:

ON - TRST signal from ISO JTAG circuit will be connected to F28M35xx. Needed during JTAG debug using ISO JTAG.

OFF - TRST signal from ISO JTAG circuit will NOT be connected to F28M35xx. Needed when the application is running from flash at power up without the JTAG connections.

Position 2:

ON - RS-232 transceiver will be enabled and allow communication through a serial cable via pins 2 and 42 of the DIMM-100 socket. Putting SW3 in the "ON" position will allow the F28M35xx controlCARD to be DIMM signal compatible with the F2808, F28044, F28335, F28035 and F28027 controlCARDs. GPIO-28 will be stuck as logic high in this position.

OFF - The default option. SW5 in the "OFF" position allows GPIO-28 to be used as a GPIO. Serial communication is still possible, through the FTDI – FT2232 chip.

5. Connectivity mux connector (ABC)

F28M35xx MCU GPIO functions have been partitioned as "connectivity ports" and "control ports". DIMM 100 connector supports all the control signals/standard communication functions and maintains compatibility across all C2000 28x device families.

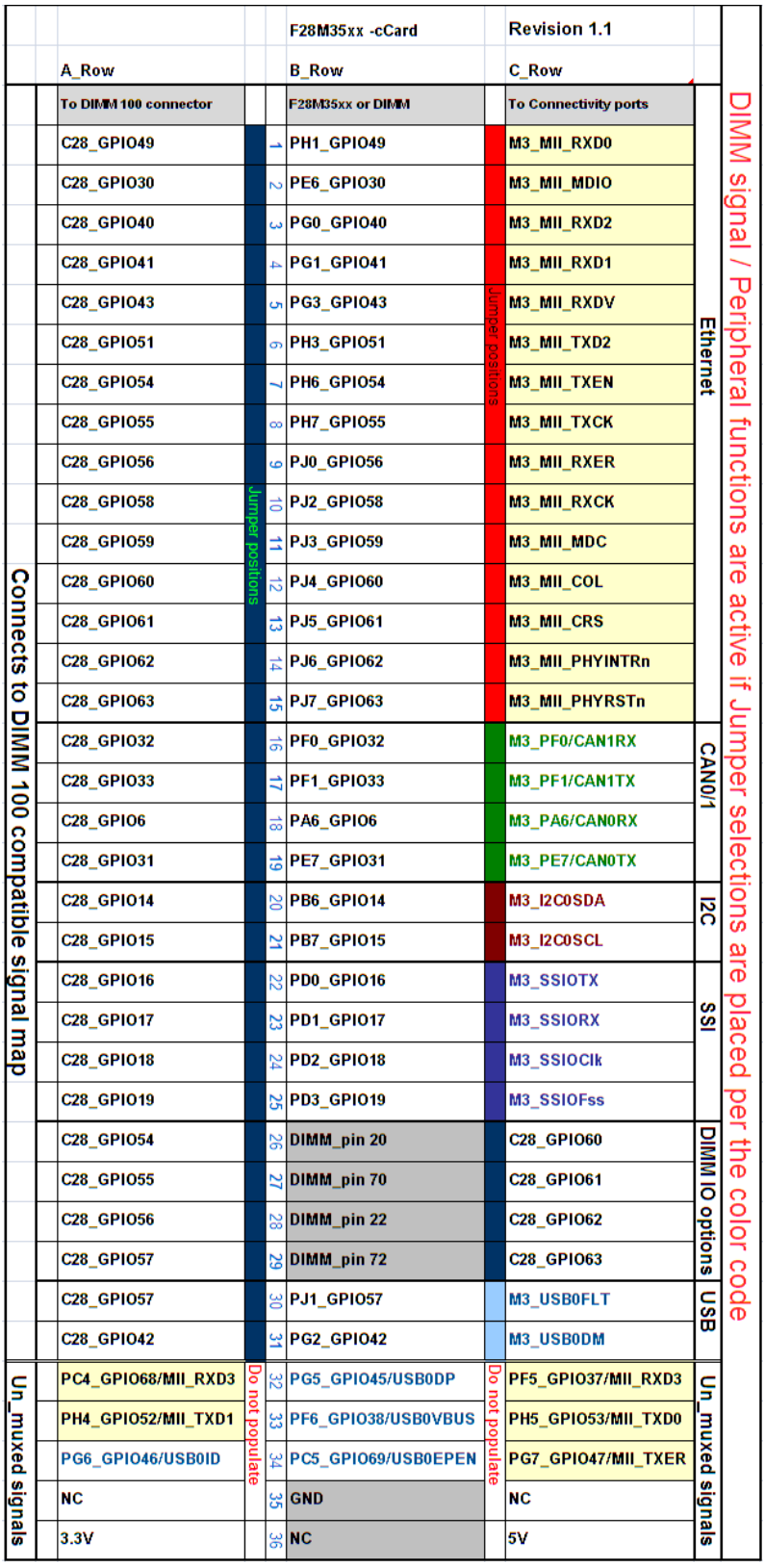
Connectivity mux – The mux uses physical jumpers to allow easy access to the connectivity ports on the top edge of the card (i.e. USB, Ethernet, uSDCARD) or redirects the GPIOs to the DIMM100 connector to maintain signal compatibility with the C2000 legacy applications and devices.

Unmuxed signals (pins 32 -36) should not be populated with jumpers. These are signals are intended to be used with boards that can be connected to Connectivity Mux.

6. MAC address

Concerto device Ethernet examples use a fixed TI's MAC address: **A8-63-F2-00-00-80.**
Refer to the board label for a unique TI's MAC ID assigned for each Concerto controlCARD. User applications can program a fixed MAC address in the non-volatile memory reserved for MAC address. Refer to device documentation for details.

7. F28M35xx control/connectivity signal mapping using the connectivity mux:



	A_Row			F28M35xx -cCard B_Row		Revision 1.1 C_Row	
Connects to DIMM 100 compatible signal map	To DIMM 100 connector	Jumper positions		F28M35xx or DIMM	Jumper positions	To Connectivity ports	DIMM signal / Peripheral functions are active if Jumper selections are placed per the color code
	C28_GPIO49		1	PH1_GPIO49		M3_MII_RXD0	Ethernet
	C28_GPIO30		2	PE6_GPIO30		M3_MII_MDIO	
	C28_GPIO40		3	PG0_GPIO40		M3_MII_RXD2	
	C28_GPIO41		4	PG1_GPIO41		M3_MII_RXD1	
	C28_GPIO43		5	PG3_GPIO43		M3_MII_RXDV	
	C28_GPIO51		6	PH3_GPIO51		M3_MII_TXD2	
	C28_GPIO54		7	PH6_GPIO54		M3_MII_TXEN	
	C28_GPIO55		8	PH7_GPIO55		M3_MII_TXCK	
	C28_GPIO56		9	PJ0_GPIO56		M3_MII_RXER	
	C28_GPIO58		10	PJ2_GPIO58		M3_MII_RXCK	
	C28_GPIO59		11	PJ3_GPIO59		M3_MII_MDC	
	C28_GPIO60		12	PJ4_GPIO60		M3_MII_COL	
	C28_GPIO61		13	PJ5_GPIO61		M3_MII_CRS	
	C28_GPIO62		14	PJ6_GPIO62		M3_MII_PHYINTRn	
	C28_GPIO63		15	PJ7_GPIO63		M3_MII_PHYRSTn	
	C28_GPIO32		16	PF0_GPIO32		M3_PF0/CAN1RX	CAN0/1
	C28_GPIO33		17	PF1_GPIO33		M3_PF1/CAN1TX	
	C28_GPIO6		18	PA6_GPIO6		M3_PA6/CAN0RX	
	C28_GPIO31		19	PE7_GPIO31		M3_PE7/CAN0TX	
	C28_GPIO14		20	PB6_GPIO14		M3_I2C0SDA	I2C
	C28_GPIO15		21	PB7_GPIO15		M3_I2C0SCL	
	C28_GPIO16		22	PD0_GPIO16		M3_SSIOTX	SSI
	C28_GPIO17		23	PD1_GPIO17		M3_SSIORX	
	C28_GPIO18		24	PD2_GPIO18		M3_SSIOClk	
	C28_GPIO19		25	PD3_GPIO19		M3_SSIOFss	
	C28_GPIO54		26	DIMM_pin 20		C28_GPIO60	DIMM IO options
	C28_GPIO55		27	DIMM_pin 70		C28_GPIO61	
	C28_GPIO56		28	DIMM_pin 22		C28_GPIO62	
	C28_GPIO57		29	DIMM_pin 72		C28_GPIO63	
	C28_GPIO57		30	PJ1_GPIO57		M3_USB0FLT	USB
	C28_GPIO42		31	PG2_GPIO42		M3_USB0DM	
Un_muxed signals	PC4_GPIO68/MII_RXD3	Do not populate	32	PG5_GPIO45/USB0DP	Do not populate	PF5_GPIO37/MII_RXD3	Un_muxed signals
	PH4_GPIO52/MII_TXD1		33	PF6_GPIO38/USB0VBUS		PH5_GPIO53/MII_TXD0	
	PG6_GPIO46/USB0ID		34	PC5_GPIO69/USB0EPEN		PG7_GPIO47/MII_TXER	
	NC		35	GND		NC	
	3.3V		36	NC		5V	

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

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8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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