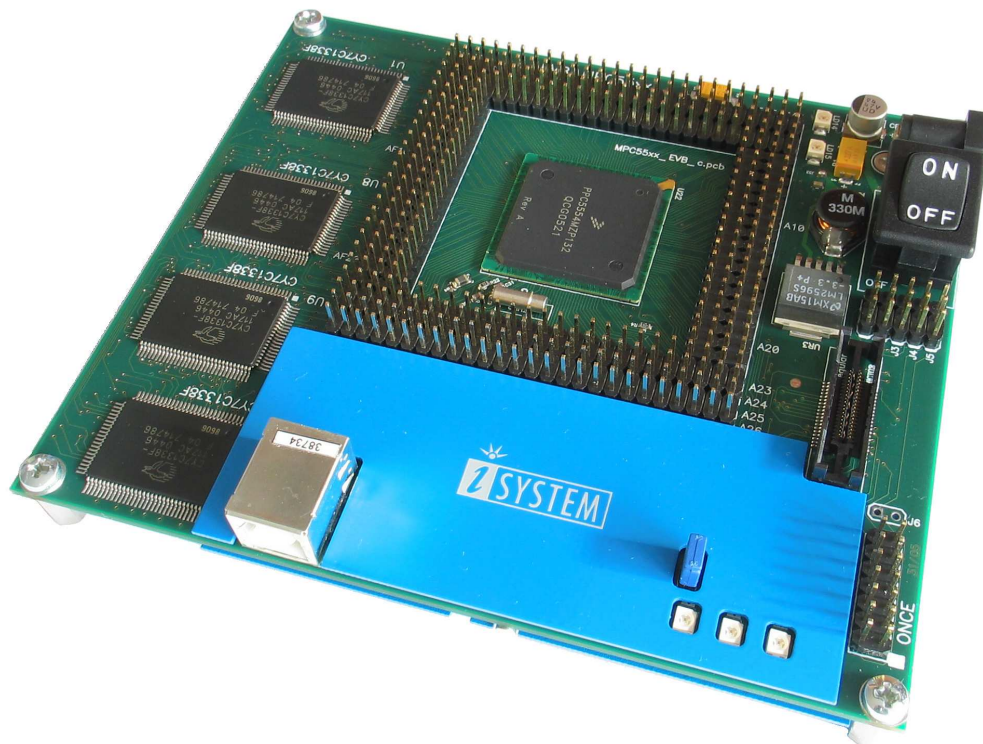

User's Manual

EVB-5554 Evaluation & Development Kit for Freescale PowerPC MPC5554 Microcontroller

	Ordering code
EVB-5554	ITMPC5554



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Features

The ITMPC5554 Target Board is an evaluation and a development system for the Freescale MPC5554 microcontroller. The ITMPC5554 package consists of a USB cable, a power supply and a target board populated with the Freescale MPC5554 CPU, 2 MB SRAM (4 devices 128Kx32-bit), JTAG debug and Nexus debug connectors and an on-board integrated iSYSTEM JTAG debugger. The application under the development or test can run from the internal CPU flash or from the external SRAM.

Specifications

Clock Speed – up to 132 MHz

Power requirement: 6 - 12V DC , + in the center @ 500 mA

Power output: 5V, 3.3V, and 2.5V regulated supplies

Board Size: 131 mm x 110 mm

EVB-5554 Features

- MPC5554
- Ext. 2Mbit (4 devices 128K x 32-bit) SRAM (CY7C1338F)
- 8MHz clock (ext. crystal)
- Power Indicators – Supply voltage indications for 5V, 3.3V, and 2.5V supplies
- User Indicator – two user indicators to provide user conceived visual response during testing
- Configuration jumper - Jumpers J1 to J5 configures processor startup mode; Jumper J6 enables/disables the iSYSTEM on-board integrated USB-JTAG debugger
- Two debug options available – JTAG, Nexus
- Low cost and user friendly support manual and software

Software Development

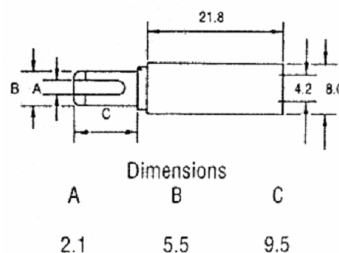
The board has been tested and does run at speeds up to 132 MHz, which you can set by engaging the PLL module in your software. Software development on the EVB-5554 can be performed using the iSYSTEM on-board integrated USB-JTAG debugger. Alternatively, external development tools can be connected to the ONCE (JTAG) or P2 (Nexus) connector. This provides real-time access to all hardware, peripherals and memory on the board. Software is usually uploaded to the external SRAM where it's executed during the development. Then it can be programmed into the CPU Flash in order to execute in standalone when the power is applied.

Getting Started - Setting up the EVB-5554 Board

Power Supply

Permissible input voltage: 6-12 V DC, + **in the center**. The required current load capacity of the power supply depends on the specific configuration of the ITMPC5554. A power supply with a minimum of 500mA is recommended and delivered in the package. Low voltage DC plug must conform to the DIN 45323 standards:

- The hole diameter is 1.95 – 2.5 mm (standard: 2.1 mm)
- The external diameter is 6.2 - 5.5 mm (standard: 5.5 mm)



Switch-on the EVB-5554 after the AC adapter is plugged into the wall and connected to the EVB-5554. Check that power indicators (LD11, LD12, LD13) lit, indicating that 5V, 3.3V and 2.5V voltage is present.

Note: When connecting an external debugger, make sure that the emulator is powered on first, then the target board and vice versa when switching off the system. First, switch off the target and then the emulator.

Use of On-Board Integrated Debugger

Follow below instructions, in order to get a sample application running with “out of the box” experience.

If winIDEA 2007 CD is not part of the package, please obtain winIDEA 2007 setup from your local iSYSTEM office or from www.isystem.com.

- Install winIDEA 2007 (IDE) full setup on a PC.
- Set jumpers J1-J5 in their default position.
- Set jumper J6, which enables on-board integrated debugger.
- Make sure that power switch on the ITMPC5554 is in off position.
- Connect the power supply to the ITMPC5554.
- Switch on the ITMPC5554.
- Run winIDEA by selecting Start>Programs>... and open ITMPC5554 sample workspace (.jrf) running from the internal flash c:\winIDEA\2007\Examples\Targets\ITMPC5554\IntFLASH).
- Connect USB cable between the PC and the ITMPC5554.
- Windows should auto-detect a new USB device and install belonging USB driver. In case of any problems, the driver is located under winIDEA install directory (e.g. c:\winIDEA\2007\USBDrv).
- Execute Debug/Download. This should program and run the application until main function.
- The application is now ready for debugging. If you run the application, a successful operation is indicated with blinking LED LD11 and LD12.

The on-board integrated USB-JTAG debugger runs without restrictions for 90 days after using it for the first time. After the 90 day period expires, the debugger falls back to a restriction of a 32k byte download limit.

The debugger can be upgraded to a regular debugger (no limits) by purchasing the debug enable license. Additionally, you need to purchase a regular winIDEA license. Please contact your local iSYSTEM distributor for more details on upgrading your development tool.

What To Do Now?

winIDEA allows you to run code step by step, set execution and access breakpoints, examine and modify the source code, rebuild the project using GNU compiler, which is optionally installed during winIDEA installation, and much more. For more information refer to the winIDEA documentation. Software in the combination with the development board can be used as a basis for developing future applications also on your hardware. This project illustrates various programming issues, which are essential to all winIDEA projects:

- Initialization of bus interface unit
- Initialization of configuration registers
- Implementation of dispatch table
- Format of linker definition file
- Correct project settings (Project>Settings), which ensure that the compiler is invoked successfully

More interesting examples are also included on the support CD.

Troubleshooting

EVB-5554 doesn't show signs of life by first start

- a) Check the power supplied to the EVB board – Diodes LD11, LD12 and LD13.
- b) When using the on-board integrated JTAG debugger, make sure that Jumper J6 is enabled. When Jumper J6 is not enabled, a connection to the JTAG or Nexus port must be made.
- c) Try "slow" JTAG Scan Speed if the debugger cannot connect to the CPU.
- d) Execute debug Reset instead of debug Download.

Unable to download the code to the board

- a) Check the power supplied to the EVB board.
- b) Ensure that the correct workspace was loaded into winIDEA.
- c) Check the hardware configuration:
 - Tools>Hardware Plug-In
 - Hardware>Hardware ...
 - Hardware>Emulation Options
- d) Reset the board and try to connect again.

Checksum failed error

- a) When performing any kind of checksum, remove all software breakpoints

Default Memory Map

The MPC5554 of the MPC5500 family has two levels of memory hierarchy. The fastest accesses are to the unified 32 Kbytes cache. The next level in the hierarchy contains the 96-Kbyte internal SRAM and internal 2MB Flash memory. Both the internal SRAM and the Flash memory can hold instructions and data. The external bus interface has been designed to support most of the standard memories used with the MPC55xx family. The provided software uses the default memory map. If you modify the memory map make sure that all memory banks and chip select configuration settings are adjusted accordingly.

EVB-5554 Memory Map

Internal Memory

Address Range	Memory Type	Description
0x 0000 0000- 0x 001F FFFF	2MB - Internal Flash Memory	Internal Flash memory (512KB – 2MB)
0x 2000 0000- 0x 3FFF FFFF	512MB - External Memory	External Memory (see note below)
0x C3F0 0000- 0x C3F0 3FFF	Bridge A Peripherals	Acts as an interface between the system bus and the lower bandwidth peripherals
0x FFF0 0000- 0x FFFF FFFF	Bridge B Peripherals	Acts as an interface between the system bus and the lower bandwidth peripherals
0x 4000 0000- 0x 4000 7FFF	Internal SRAM, Powered Standby	32 Kbytes
0x 4000 8000- 0x 4000 FFFF	Internal SRAM	32 Kbytes

External Memory

There are 4 SRAM devices connected to CS1 and CS2 and cover a 2MB memory area. Offset depends on the CPU configuration. In our case, CS1 is configured to point at 0x2000 0000 through the winIDEA initialization sequence.

Address Range
0x 2000 0000 – 0x 2007 FFFF
0x 2008 0000 – 0x 200F FFFF
0x 2010 0000 – 0x 2017 FFFF
0x 2018 0000 – 0x 201F FFFF

SRAM Memory

The MPC5554 internal SRAM module provides a general-purpose 96-Kbyte memory block that supports mapped read/write accesses from any master. Included within the 96-Kbyte SRAM block is a 32-Kbyte block powered by a separate supply for a standby operation.

Flash Memory

The MPC5554 provides 2 Mbytes of programmable, non-volatile, Flash memory storage. The non-volatile memory (NVM) can be used for instruction and/or data storage.

Downloading the code into the memory

winIDEA allows you to load the code directly into the internal Flash memory through the standard debug download. winIDEA identifies, which code from the download file fits in the internal FLASH, and loads it to the Flash through the flash programming procedure hidden to the user. All other code propagates to the target through standard memory writes.

Demo software has the example configured for the internal Flash. Load the project into winIDEA and execute debug download (Debug->Download), which will download the code directly to the Flash memory. For more information see the winIDEA users manual.

Demo software has also the example configured for the external SRAM. Load the project into winIDEA and execute debug download (Debug->Download), which will download the code to the external SRAM. Access to the external SRAM is configured in the initialization sequence ('Hardware/Emulation Options/Initialization' tab), which winIDEA executes prior to debug download.

Settings and Options

Jumpers

Jumpers J1 to J5 configures processor startup mode. See MPC5554 Reference Manual for more details on the CPU signals BOOTCFG[0:1], PLLCFG[0:1] and WKPCFG. Some boards may not have J1-J5 populated since the CPU has internal pull-ups/downs on belonging signals, which match with the default jumper settings. Jumper J6 selects whether iSYSTEM on-board integrated USB-JTAG debugger is used or an external debug tool.

Jumper pin 1 is marked with a white square on the ITMPC5554 PCB. If pin 1 cannot be located directly from the ITMPC5554, please use Figure 2 for assistance.

Note: Don't change jumper settings while the ITMPC5554 Target Board is supplied with power!

J1	BOOTCFG0
1-2*	BOOTCFG0 = 0
2-3	BOOTCFG0 = 1
J2	BOOTCFG1
1-2*	BOOTCFG1 = 0
2-3	BOOTCFG1 = 1
J3	PLLCFG0
1-2	PLLCFG0 = 0
2-3*	PLLCFG0 = 1
J4	PLLCFG1
1-2	PLLCFG1 = 0
2-3*	PLLCFG1 = 1
J5	WKPCFG
1-2	WKPCFG = 0
2-3*	WKPCFG = 1
J6	Debug mode
Closed*	Enable integrated USB-JTAG debugger
Open	External debugger

Figure 1: Jumper configuration (* - default position)

Status Indicators

Three LED diodes show the presence of supply voltages. LD11 (+5V), LD12 (+3.3V) and LD13 (+2.5V) must light when the power is applied to the evaluation board. LD14 and LD15 are available for the user as a status indicator.

Component List

Name	Description
U22	Motorola MPC5554 CPU
U1,U8,U9,U10	SRAM Cypress CY7C1338F
P1(bottom)	Connector for manufacturing purpose
P2	Nexus debug connector
P4	Power supply connector
ONCE	JTAG debug connector
J1	BOOTCFG0
J2	BOOTCFG1
J3	PLLCFG0
J4	PLLCFG1
J5	WKPCFG
J6	Debug mode
J28	USB connector (integrated debugger)
LD11	Power LED 5V
LD12	Power LED 3,3V
LD13	Power LED 2,5V
LD14	User LED
LD15	User LED
SW1	Power switch

Connectors

14-pin JTAG debug connector (ONCE)

CPU_TDI	1	2	GND
CPU_TDO	3	4	GND
CPU_TCK	5	6	GND
N.C.	7	8	N.C.
CPU_RESET	9	10	CPU_TMS
3V3	11	12	N.C.
N.C.	13	14	CPU_TRST

External JTAG debug tool connects to a 14-pin JTAG debug connector. **Jumper J6 must be open when using external debugger.**

Nexus 38-pin Mictor debug connector

Signal	Pin	Pin	Signal
Not used	1	2	Not used
Not used	3	4	Not used
MDO9	5	6	CLKOUT
BOOTCFG	7	8	MDO8
RSTIN	9	10	EVTIN
TDO	11	12	VTREF
MDO10	13	14	RDY
TCK	15	16	MDO7
TMS	17	18	MDO6
TDI	19	20	MDO5
NTRST	21	22	MDO4
MDO11	23	24	MDO3
Not used	25	26	MDO2
Not used	27	28	MDO1
Not used	29	30	MDO0
Not used	31	32	EVTO
Not used	33	34	MCKO
Not used	35	36	MSEO1
Not used	37	38	MSEO0

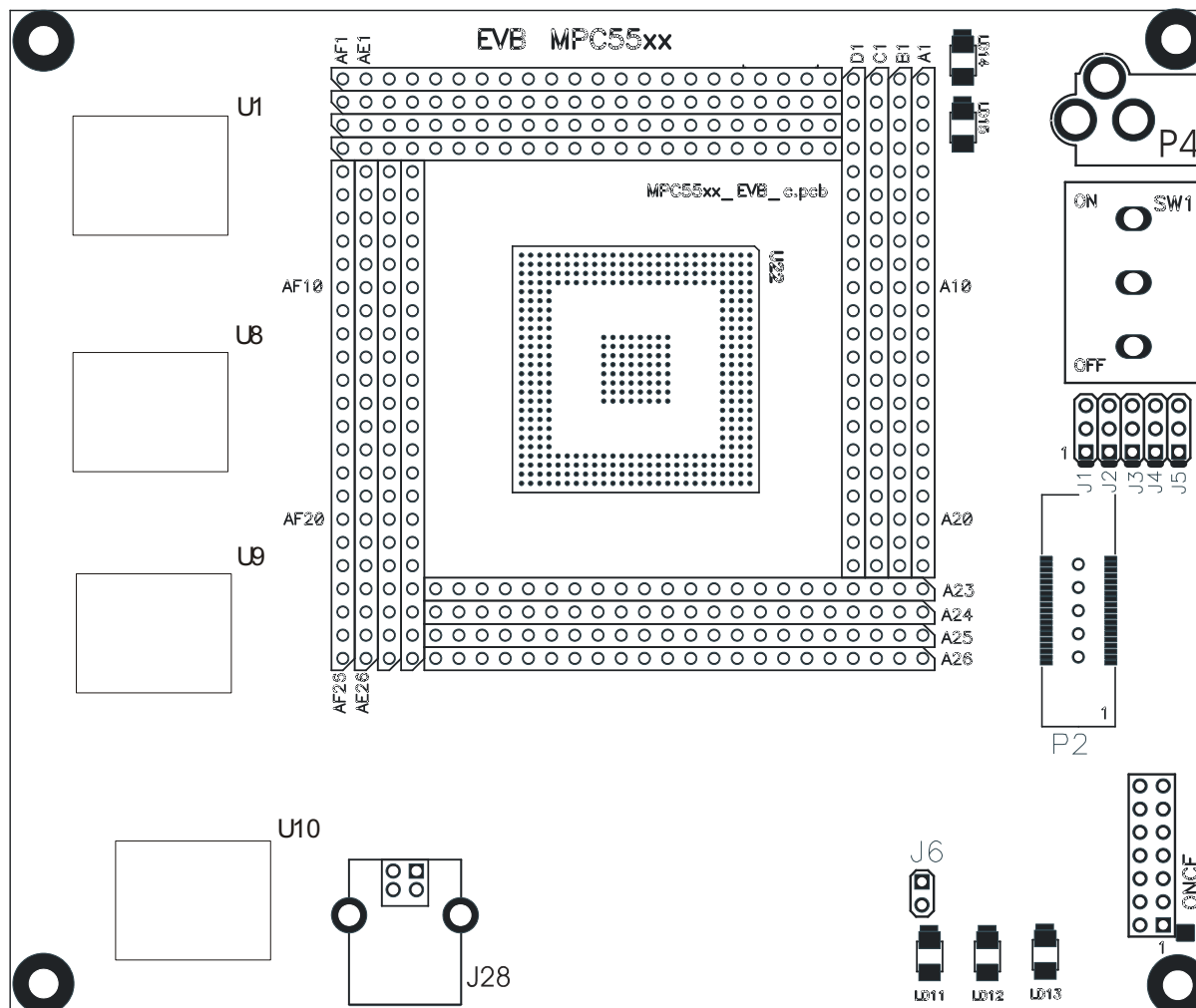
External Nexus debug tool connects to a Nexus 38-pin Mictor debug connector. **Jumper J6 must be open when using external debugger.**

CPU expansion connector

The CPU expansion connector makes all the CPU signals accessible and can be used in order to expand the development system by connecting the ITMPC5554 to another module. The CPU expansion connector uses the same numbering scheme as the original CPU in the PBGA416 package. The CPU expansion connector builds the matrix that matches with the CPU PBGA416 pinout.

Appendix A

View of the ITMPC5554



Note: A designation on *Figure 4* stands for A1 designation on the above ITMPC5554 view, B stands for B1, AF stands for AF1 etc.

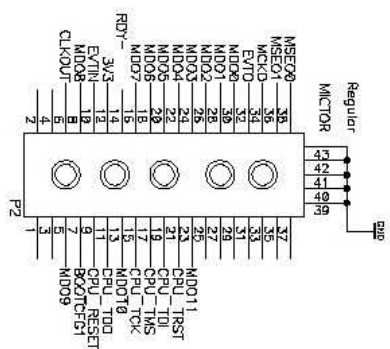
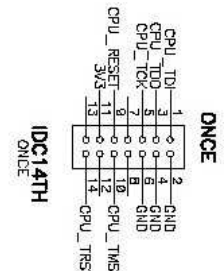
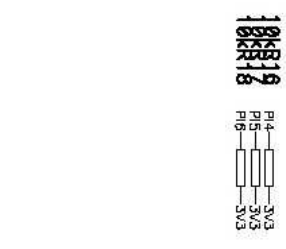
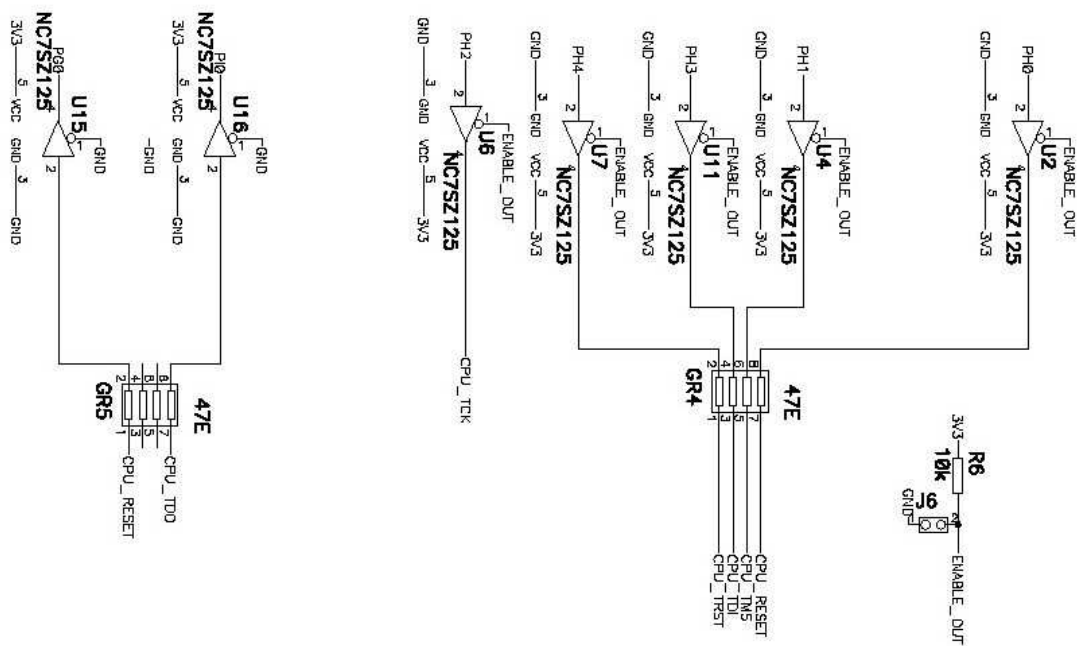
A	V _{SS}	V _{5BY}	AN37	AN11	V _{DDA}	AN16	AN1	AN5	VRH	AN23	AN27	AN28	AN35	V _{SS}	AN15	ETR _{G1}	ETPUB18	ETPUB20	ETPUB24	ETPUB27	GPIO205	MD011	MD08	V _{DD}	V _{DDJ3}	V _{SS}	A
B	V _{DD}	V _{SS}	AN36	AN39	AN19	AN20	AN0	AN4	BIAS _R	AN22	AN26	AN31	AN32	V _{SS}	AN14	ETR _{G0}	ETPUB21	ETPUB25	ETPUB28	ETPUB31	MD010	MD07	MD04	MD00	V _{SS}	V _{DDF7}	B
C	V _{DD33}	V _{DD}	V _{SS}	AN8	AN17	V _{SSA}	AN21	AN3	AN7	VRL	AN25	AN30	AN33	V _{DDF9}	AN13	ETPUB19	ETPUB22	ETPUB26	ETPUB30	MD09	MD06	MD03	MD01	V _{SS}	V _{DDF7}	V _{DD}	C
D	ETPUBA30	ETPUBA31	V _{DD}	V _{SS}	AN38	AN9	AN10	AN18	AN2	AN6	AN24	AN29	AN34	V _{DDF9}	AN12	ETPUB16	ETPUB17	ETPUB23	ETPUB29	MD05	MD02	V _{DDF8}	V _{SS}	V _{DDF7}	TCK	TDI	D
E	ETPUBA28	ETPUBA29	V _{DDF8}	V _{DD}	(As viewed from the top of the package)																				TEST	E	
F	ETPUBA24	ETPUBA27	ETPUBA26	V _{DDF8}																					EVTO	F	
G	ETPUBA23	ETPUBA22	ETPUBA25	ETPUBA21																					ETPUB15	G	
H	ETPUBA20	ETPUBA19	ETPUBA18	ETPUBA17																					ETPUB13	H	
J	ETPUBA16	ETPUBA15	ETPUBA14	ETPUBA13																					ETPUB9	J	
K	ETPUBA12	ETPUBA11	ETPUBA10	ETPUBA9																					ETPUB5	K	
L	ETPUBA8	ETPUBA7	ETPUBA6	ETPUBA5																					ETPUB2	L	
M	ETPUBA4	ETPUBA3	ETPUBA2	ETPUBA1																					SINB	M	
N	BDIP	TEA	ETPUBA0	TCRCLK _A	PCSB1	N																					
P	CS3	CS2	CS1	CS0	PCSB2	P																					
R	WE3	WE2	WE1	WE0	SCKA	R																					
T	V _{DDF2}	TSIZ0	RD_WR	V _{DDF2}	PCSA2	T																					
U	ADDR16	TSIZ1	TA	V _{DD33}	PCSA5	U																					
V	ADDR18	ADDR17	TS	ADDR8	RSTOUT	V																					
W	ADDR20	ADDR19	ADDR9	ADDR10	TXDB	W																					
Y	ADDR22	ADDR21	ADDR11	V _{DDF2}	V _{RCVSS}	Y																					
AA	ADDR24	ADDR23	ADDR13	ADDR12	EXTAL	AA																					
AB	V _{DDF2}	ADDR25	ADDR15	ADDR14	V _{DD}	V _{RCCTL}	PLLCFG0	XTAL	AB																		
AC	ADDR26	ADDR27	ADDR31	V _{SS}	V _{DD}	DATA26	DATA28	V _{DDF2}	DATA30	DATA31	DATA8	DATA10	V _{DDF2}	DATA12	DATA14	EMIOS2	EMIOS8	EMIOS12	EMIOS21	V _{DDF4}	V _{DDF5}	NC	V _{SS}	V _{DD}	V _{RC33}	V _{DD3YN}	AC
AD	ADDR28	ADDR30	V _{SS}	V _{DD}	DATA24	DATA25	DATA27	DATA29	V _{DD33}	GPIO207	DATA9	DATA11	DATA13	DATA15	EMIOS3	EMIOS6	EMIOS10	EMIOS15	EMIOS17	EMIOS22	CNTXA	V _{DDF5}	NC	V _{SS}	V _{DD}	V _{DD33}	AD
AE	ADDR29	V _{SS}	V _{DD}	DATA17	DATA19	DATA21	DATA23	DATA20	DATA2	DATA4	DATA6	OE	BE	BE	EMIOS1	EMIOS5	EMIOS9	EMIOS13	EMIOS16	EMIOS19	EMIOS23	CNRXA	V _{DDF5}	CLKOUT	V _{SS}	V _{DD}	AE
AF	V _{SS}	V _{DD}	DATA16	DATA18	V _{DDF2}	DATA20	DATA22	GPIO206	DATA1	DATA3	V _{DDF2}	DATA5	DATA7	BE	EMIOS0	EMIOS4	EMIOS7	EMIOS11	EMIOS14	EMIOS18	EMIOS20	CNTXB	CNRXB	V _{DDF5}	ENGCLK	V _{SS}	AF
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

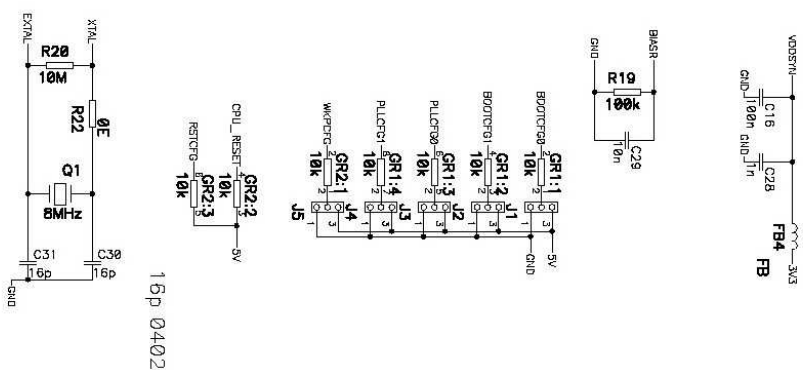
(As viewed from the top of the package)

Figure 4: Expansion connector

Schematic

Note: On-board integrated JTAG debugger is not part of the schematic.





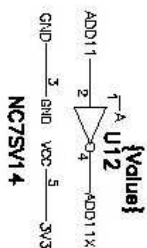
1A	1B	1C	1D
NET00078 1	3V3 1	VDD 1	GND 1
NET00079 2	VDD 2	GND 2	GND 2
VDD 3	GND 3	NET00045 3	NET00015 3
GND 4	NET00054 4	NET00046 4	NET00044 4
NET00080 5	NET00065 5	NET00048 5	5V 5
NET00081 6	GND 6	NET00049 6	NET00019 6
NET00082 7	NET00066 7	NET00050 7	NET00028 7
NET00083 8	NET00067 8	NET00051 8	NET00030 8
NET00084 9	NET00068 9	BIASR 9	5V 9
NET00085 10	GND 10	NET00052 10	NET00033 10
NET00086 11	NET00070 11	NET00053 11	NET00034 11
NET00087 12	NET00071 12	NET00054 12	NET00036 12
NET00088 13	NET00072 13	NET00057 13	NET00036 13
5V 14	5V 14	GND 14	GND 14
NET00089 15	NET00073 15	NET00058 15	NET00037 15
NET00090 16	NET00074 16	NET00059 16	NET00038 16
NET00091 17	NET00075 17	NET00060 17	NET00040 17
NET00092 18	NET00076 18	NET00061 18	NET00041 18
NET00093 19	NET00077 19	NET00062 19	NET00042 19
MDO5 20	MDO9 20	NET00063 20	NET00043 20
MDO2 21	MDO8 21	MDO10 21	NET00044 21
5V 22	MDO3 22	MDO7 22	MDO11 22
2A	2B	2C	2D
MDO8 1	VDD 1	3V3 1	GND 1
MDO4 2	MDO0 2	GND 2	3V3 2
MDO1 3	GND 3	3V3 3	VDD 3
GND 4	3V3 4	CPU_TCK 4	CPU_TDI 4
3V3 5	CPU_TMS 5	CPU_TDO 5	NET00094 5
MSE00 6	CPU_TRST 6	EVTIN 6	EVT0 6
MSE01 7	MCKD 7	LED2 7	NET00095 7
NET00096 8	LED1 8	NET00097 8	NET00101 8
5V 9	NET00099 9	NET00100 9	NET00105 9
NET00102 10	NET00103 10	NET00104 10	NET00109 10
NET00106 11	NET00107 11	NET00108 11	NET00113 11
NET00110 12	NET00111 12	NET00112 12	NET00117 12
NET00114 13	NET00115 13	NET00116 13	NET00121 13
NET00118 14	NET00119 14	NET00120 14	NET00125 14
NET00122 15	NET00123 15	NET00124 15	5V 15
NET00126 16	NET00127 16	NET00128 16	3V3 16
NET00129 17	NET00130 17	NET00131 17	RSTCFG 17
NET00132 18	NET00133 18	NET00134 18	CPU_RESET 18
NET00138 19	NET00139 19	NET00140 19	EXTAL- 19
WKPCFG 20	BOOTCFG1 20	GND 20	XTAL- 20
5V 21	PLLCFG1 21	BOOTCFG0 21	
VDD 22	VRCCTL 22	PLLCFG0 22	
3A	3B	3C	3D
VDDSYN 1	3V3 1	VDD 1	GND 1
3V3 2	VDD 2	GND 2	NET00136 2
VDD 3	GND 3	CLKOUT 3	3V3 3
GND 4	NET00137 4	3V3 4	NET00135 4
NET00141 5	3V3 5	NET00142 5	NET00143 5
3V3 6	NET00144 6	NET00145 6	NET00148 6
5V 7	NET00147 7	NET00148 7	NET00149 7
NET00150 8	NET00151 8	NET00152 8	NET00153 8
NET00154 9	NET00155 9	NET00156 9	NET00157 9
NET00158 10	NET00159 10	NET00160 10	NET00181 10
NET00162 11	NET00163 11	NET00164 11	NET00185 11
DATA14 12	NET00167 12	NET00165 12	NET00186 12
DATA12 13	DATA15 13	NET00168 13	NET00189 13
3V3 14	DATA16 14	NET00172 14	NET00173 14
DATA10 15	DATA11 15	NET00175 14	DATA7 15
DATA8 16	DATA9 16	EO 15	DATA5 15
DATA31 17	NET00203 17	DATA6 16	3V3 16
DATA30 18	3V3 18	DATA4 17	DATA3 17
3V3 19	DATA29 19	DATA2 18	DATA1 18
DATA28 20	DATA27 20	DATA0 19	NET00198 19
DATA26 21	DATA25 21	DATA23 20	DATA22 20
VDD 22	DATA24 22	DATA21 21	DATA20 21
4A	4B	4C	4D
DATA18 1	DATA16 1	VDD 1	GND 1
DATA17 2	VDD 2	GND 2	ADD20 2
VDD 3	GND 3	ADD30 3	ADD28 3
GND 4	ADD31 4	ADD27 4	ADD26 4
ADD14 5	ADD15 5	ADD25 5	3V3 5
ADD12 6	ADD13 6	ADD23 6	ADD24 6
3V3 7	ADD11 7	ADD21 7	ADD22 7
ADD10 8	ADD9 8	ADD19 8	ADD20 8
ADD8 9	TS 9	ADD17 9	ADD18 9
3V3 10	NET00231 10	NET00232 10	ADD16 10
3V3 11	RD_WR 11	NET00235 11	3V3 11
WE0 12	WE1 12	WE2 12	WE3 12
CSRAM 13	NET00241 13	NET00242 13	NET00274 13
NET00275 14	NET00276 14	NET00277 14	BDIP 14
NET00270 15	NET00271 15	NET00272 15	NET00273 15
NET00266 16	NET00267 16	NET00268 16	NET00269 16
NET00262 17	NET00263 17	NET00264 17	NET00265 17
NET00258 18	NET00259 18	NET00260 18	NET00261 18
NET00254 19	NET00255 19	NET00256 19	NET00257 19
NET00250 20	NET00251 20	NET00252 20	NET00253 20
5V 21	NET00247 21	NET00248 21	NET00249 21
VDD 22	5V 22	NET00245 22	NET00246 22

U1		U2		U3		U4		U5		U6		U7		U8		U9		U10		U11		U12		U13		U14		U15		U16		U17		U18		U19		U20		U21		U22		U23		U24		U25		U26		U27		U28		U29		U30		U31		U32		U33		U34		U35		U36		U37		U38		U39		U40		U41		U42		U43		U44		U45		U46		U47		U48		U49		U50		U51		U52		U53		U54		U55		U56		U57		U58		U59		U60		U61		U62		U63		U64		U65		U66		U67		U68		U69		U70		U71		U72		U73		U74		U75		U76		U77		U78		U79		U80		U81		U82		U83		U84		U85		U86		U87		U88		U89		U90		U91		U92		U93		U94		U95		U96		U97		U98		U99		U100																																																																																																																																																																							
DAT1A31	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415

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DAT432	53	53	MODE
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DAT434	57	54	AND
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DAT436	59	54	85
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DAT451	75	54	100
DAT452	76	54	101
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DAT454	78	54	103
DAT455	79	54	104
DAT456	80	54	105
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DAT459	83	54	108
DAT460	84	54	109
DAT461	85	54	110
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DAT466	90	54	115
DAT467	91	54	116
DAT468	92	54	117
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DAT480	104	54	129
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DAT482	106	54	131
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DAT487	111	54	136
DAT488	112	54	137
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DAT490	114	54	139
DAT491	115	54	140
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DAT532	156	54	181
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DAT539	163	54	

[illegible]

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DAT43	63	NC	MODE	31
DAT44	64	NC	MODE	31
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DAT112	132	NC	MODE	31
DAT113	133	NC	MODE	31
DAT114	134	NC	MODE	31
DAT115	135	NC	MODE	31
DAT116	136	NC	MODE	31
DAT117	137	NC</		



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