MicroTech

MT ARMBoards Hardware Reference

Version 1.40

www.mcu.hk

Warning:
Incorrect power connection to any electronic and electrical equipment may seriously damage them or even cause a fire hazard or explosion. Users must take care to identify the correct pins and supply an acceptable voltage to operate them safely.

3rd May 2007

Introduction

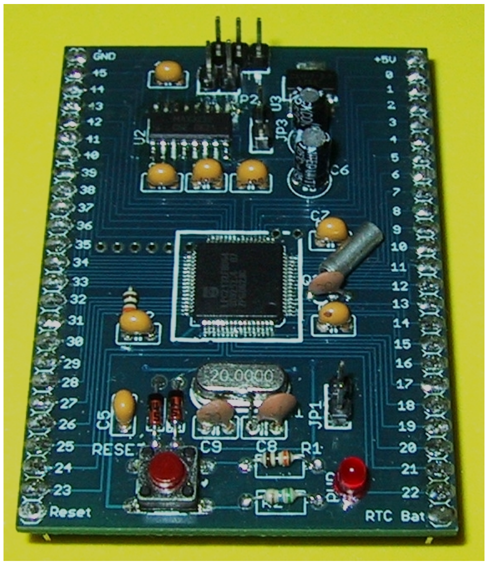
This brief technical guide describes the schematics and layouts for the MT ARMBoards. There are 2 different categories of them and they only differ in the types of ARM chips used. One category supports USB and the other does not, because of two I/O pins are dedicated to USB and therefore not available for normal I/O operation. The ARMBoards include the minimum components necessary for a basic controller, thus keeping the cost and board size to a minimum. All the pins of the MCU have been brought out side-by-side to standard 0.1" headers for interfacing other circuits.

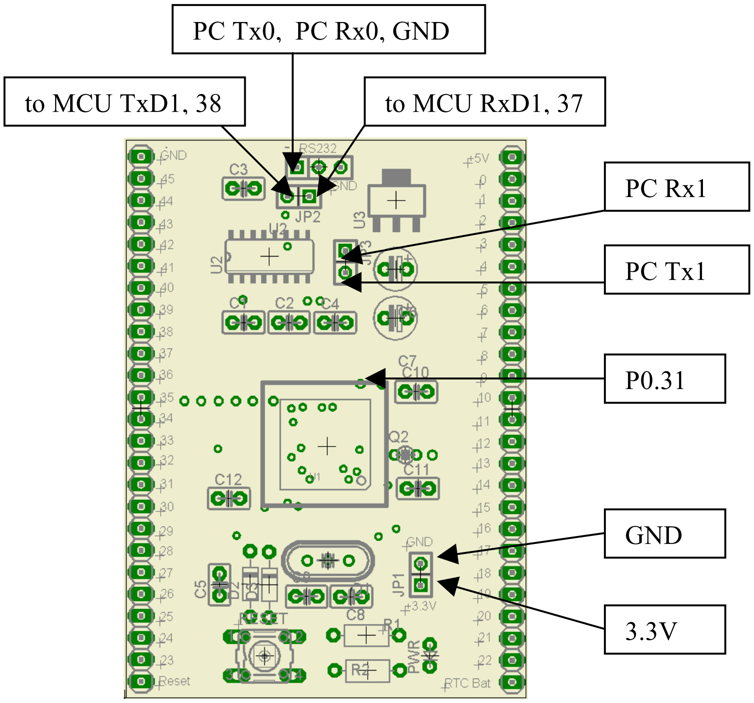
The MT ARMBoards are supplied and programmed with the MT System Code to run TinyC programs. But the end-users can erase it and used it for normal ARM development. WARNING, after erasing the contents of the ARM chip, there is no way to get the MT System Code back, you have to buy a new one from the manufacturer!

These ARMBoards are working on 3.3V and differ from those MT DemoBoards which are working on 5V. All the ARMBoards have a 1117-3.3V Low-Drop-Out (1V) voltage regulator which accepts a power supply of 4.3V to 22V DC, a system reset button and a 3.3V operated RS232 MAX3232 communication IC.

When doing I/O experiments using the MT IOBoard with an ARMBoard, it is recommended the power supply to the ARMBoard should be drawn from the IOBoard. Because the ARMBoards(3.3V) and the IOBoard(5V) are working under different voltages, and the current output from the ARMBoards may not be strong enough to power the inputs of the IOBoard. However, this can simply be remedied by using some I/O buffering ICs, such as 74LS573, to interface between the 2 boards.

Please refer to the "**MT Chips Hardware Reference**" for detailed interfacing information for connection with other components and circuits.





Note: The 3-Pin header connects to the MT PC serial download cable. JP2 connects to the second RS232 channel of MAX3232 IC and **not yet** wired to the ARMBoard's second RS232 channel (I/O Pin 37 & 38). JP3 connects to the second serial port of PC. Of course, all the Ground wires of all the devices MUST be connected together to act as the voltage reference point.

I/O Pins Configuration (for used as MT chip)

I/O Pin	I/O Pin
GND	VCC
45	0
44/AD6	1
43	2/RxD0
42/AD7	3
41/AD8	4/TxD0
40	5
39	6/AD3
38/AD9/TxD1	7/AD2
37/RxD1	8/AD1
36/AD10	9
35	10/AD0 (USB -D)
24	11/AD5 (USB +D)
33/AD11	12/AD4/DAC
32/AD12	13
31	14
30	15/Prog7/AD15
29	16/Prog6/AD14
28/LCD-S1/AD13	17/Prog5
27/LCD-S2	18/Prog4
26/LCD-S3	19/Prog3 (USB)
25/24C02-SCL	20/Prog2
24/24C02-SDA	21/Prog1
23/IR	22/Prog0/PC
Reset	RTC Bat

In case of USB type of MT ARMBoards, I/O Pin 19 is used for USB activation, and I/O Pin 10 is used as USB –D and I/O Pin 11 is used as USB +D signals and therefore not available for normal digital I/O and ADC functions. The total numbers and sizes of TinyC programs that can be stored within the chips and the numbers of ADC available amongst different types of ARM chips used are listed as follows:

Chip Type	System Clock	Program Storage	Run-Time Memory	No. of ADC	USB
LPC2132	60MHz	1 x 16K words	7K words	8 (10bits)	No
LPC2134	60MHz	1 x 32K + 1 x 16K words	7K words	16 (10bits)	No
LPC2136	60MHz	3 x 32K + 1 x 16K words	15K words	16 (10bits)	No
LPC2138	60MHz	7 x 32K + 1 x 16K words	15K words	16 (10bits)	No
LPC2142	48MHz	1 x 16K words	7K words	6 (10bits)	Yes
LPC2144	48MHz	1 x 32K + 1 x 16K words	7K words	14 (10bits)	Yes
LPC2146	48MHz	3 x 32K + 1 x 16K words	19K words	14 (10bits)	Yes
LPC2148	48MHz	7 x 32K + 1 x 16K words	19K words	14 (10bits)	Yes

Note:

- The I/O pins are designed and counted in a clockwise direction, in contrast to conventional IC pins which are counted anti-clockwise. The second from bottom-right pin of each MT ARMBoard is the PC Load pin.
- The TinyC text output functions, writes(), writei() and writec() output data to a MT serial LCD display via the pins marked ‘LCD’.
- The user can disable the three LCD pins and use them for normal I/O by connecting a 10K pull-down resistor on the S1 pin.
- The ‘RTC Bat’ pin connects to the +ve end of an external 3V battery to keep the chip clock running.
- Be careful of I/O pins 2 and 4, they are also used for UART0 for downloading new programs and normal telecommunication, be aware of any connections to these 2 pins. The same principle also apply to I/O pins 37 and 38, which are also used for UART1, but they are not connected to the MAX3232 chip on the PCB. Users have to connect them manually.
- Certain I/O pins might need pull-high resistors (1K) to work properly, when output logic high.

I/O Pins Configuration (for used as normal ARM chip development)

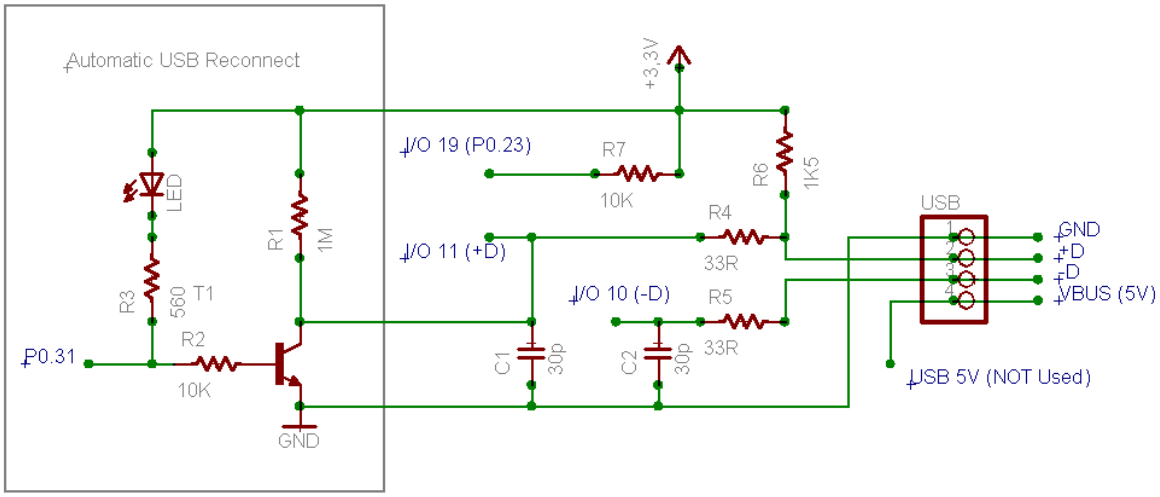
Original ARM function	Original ARM function
Ground	VCC
P0.3/SDA0/MAT0.0/EINT1	P1.26/RTCK
P0.4/AD0.6/SCK0/CAP0.1	P0.2/SCL0/CAP0.0
P1.25/EXTIN0	P0.1/RxD0/PWM3/EINT0
P0.5/AD0.7/MISO0/MAT0.1	P1.31/TRST
P0.6/AD1.0/MOSI0/CAP0.2	P0.0/TxD0/PWM1
P0.7/SSEL0/PWM2/EINT2	P1.16/TRACEPKT0
P1.24/TRACECLK	P0.30/AD0.3/EINT3/CAP0.0
P0.8/AD1.1/TxD1/PWM4	P0.29/AD0.2/CAP0.3/MAT0.3
P0.9/RxD1/PWM6/EINT3	P0.28/AD0.1/CAP0.2/MAT0.2
P0.10/AD1.2/RTS1/CAP1.0	P1.17/TRACEPKT1
P1.23/PIPESTAT2	P0.27/AD0.0/CAP0.1/MAT0.1
P0.11/CTS1/CAP1.1/SCL1	P0.26/AD0.5
P0.12/AD1.3/DSR1/MAT1.0	P0.25/AD0.4/AOUT
P0.13/AD1.4/DTR1/MAT1.1	P0.18/CAP1.3/MISO1/MAT1.3
P1.22/PIPESTAT1	P1.19/TRACEPKT3
P0.14/DCD1/EINT1/SDA1	P0.22/AD1.7/CAP0.0/MAT0.0
P0.21/PWM5/CAP1.3	P0.21/AD1.6/PWM5/CAP1.3
P0.15/AD1.5/RI1/EINT2	P1.27/TDO
P0.16/EINT0/MAT0.2/CAP02	P1.28/TDI
P0.17/CAP1.2/SCK1/MAT1.2	P0.23
P1.20/TRACESYNC	P1.29/TCK
P1.30/TMS	P0.20/MAT1.3/SSEL1/EINT3
P0.18/CAP1.3/MISO1/MAT1.3	P0.19/MAT1.2/MOSI1/CAP1.2
Ext. RESET input	Ext. 3V battery supply

When used as normal ARM development, these LPC series of ARM chips can simply be programmed through RS232 by using NXP's (Philips) LPC210x_ISP.exe ISP program. To activate ISP function, simply pull pin P0.14 LOW while resetting the MCU.

USB Activation and Connection

As already mentioned above, a total of 3 I/O pins are sacrificed when using the USB function. However, the I/O Pin 19 still available for normal digital I/O when USB is not activated. Here is the technique to find out the correct names of the wires for an USB connector, NEVER trust the wires by their colours (as said in the USB specification), they always differ from manufacturer to manufacturer. Use a voltmeter to measure the 2 wires at both ends to locate the VBUS(5V) and the Ground wires. The wire next to the Ground wire is the +D wire, the other one is the –D wire.

The following circuit shows how to connect an USB connector or wires to the ARMBoard.



The transistor circuit is working like a switch, each time the ARMBoard is reset, a positive pulse is emitted on P0.31, which temporarily turn on the NPN transistor and this bring the +D to Ground. As soon as the +D is brought to Ground, the PC will re-establish USB connection with the board. The LED works as an indicator when the chip USB function is switched on.

USB works in packet transmission mode with very limited capability to recovery. Therefore, any current active USB connection must be properly shutdown before resetting the ARMBoard, otherwise, you might have to reboot your PC!

USB Driver Installation & Testing

The Windows XP, 2000 driver for the MT ARMBoard USB virtual COM ports is located under 'MT\USB Driver' directory. Just go to that directory when prompt by the PC to install it. After a successful installation, you will find 2 extra COMx in addition to those you already have.

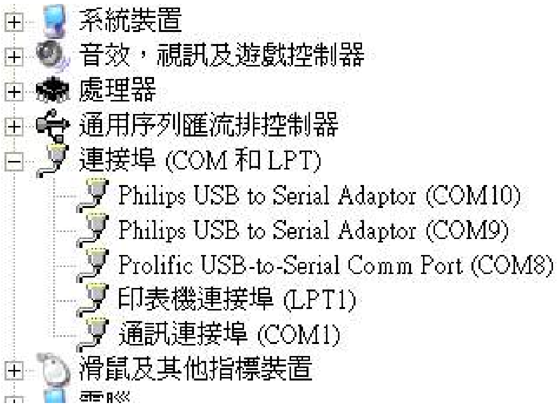
A MT ARMBoard equips with the USB functionality will not be activated by it's own, until the USB is switched on by the TinyC function sys(100, 0), with 100 as it's first parameter, the value of the second parameter is ignored. The baudrate setting for the USB COM port is done on the PC side, the ARMBoard will detect it automatically.

```
            sys(100, 0); // this will activate the USB functionality
```

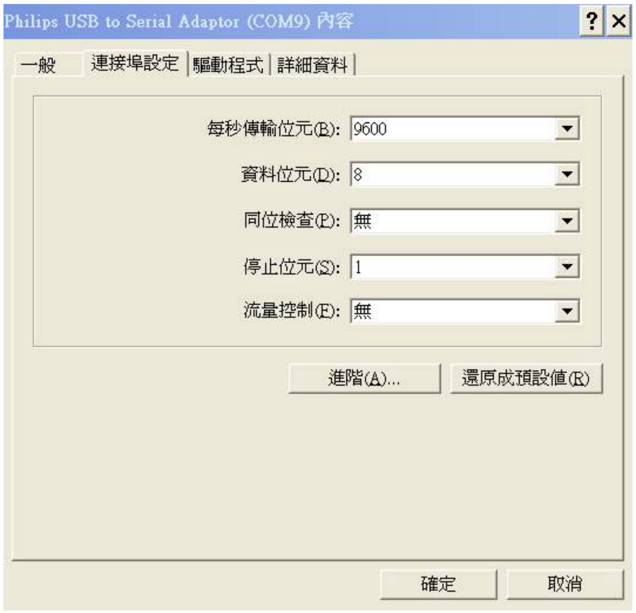
The TinyC program, '4XCOM.prg' is given to test and output 4 strings to the 4 COM ports available. You can use the XP HyperTerminal to setup 4 terminals to receive the output. Or, use MT IDE RS232 Terminal to view the output individually.

Do properly shutdown any active USB connection before resetting the ARMBoard.

PC setup:



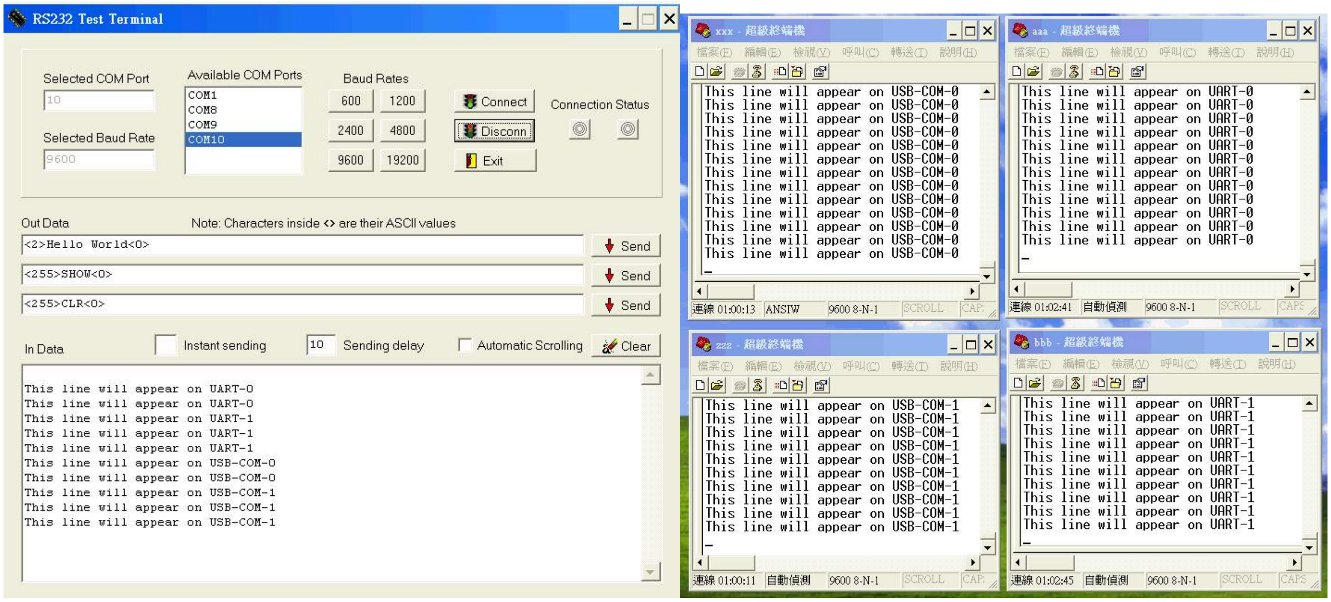
系統裝置
音效，視訊及遊戲控制器
處理器
通用序列匯流排控制器
連接埠 (COM 和 LPT)
Philips USB to Serial Adaptor (COM10)
Philips USB to Serial Adaptor (COM9)
Prolific USB-to-Serial Comm Port (COM8)
印表機連接埠 (LPT1)
通訊連接埠 (COM1)
滑鼠及其他指標裝置
電腦



Philips USB to Serial Adaptor (COM9) 內容

每秒傳輸位元(B): 9600
資料位元(D): 8
同位檢查(P): 無
停止位元(S): 1
流量控制(F): 無

Results from the testing:



Selected COM Port: 10

Available COM Ports: COM1, COM8, COM9, COM10

Selected Baud Rate: 9600

Out Data — Note: Characters inside <> are their ASCII values

```
<2>Hello World<0>
<255>SHOW<0>
<255>CLR<0>
```

□ Instant sending 10 Sending delay □ Automatic Scrolling

In Data

```
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
```

xxx - 超級終端機

```
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
This line will appear on USB-COM-0
_
```

連線 01:00:13 ANSIW 9600 8-N-1 SCROLL CAPS

aaa - 超級終端機

```
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
This line will appear on UART-0
_
```

連線 01:02:41 自動偵測 9600 8-N-1 SCROLL CAPS

zzz - 超級終端機

```
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
This line will appear on USB-COM-1
_
```

連線 01:00:11 自動偵測 9600 8-N-1 SCROLL CAPS

bbb - 超級終端機

```
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
This line will appear on UART-1
_
```

連線 01:02:45 自動偵測 9600 8-N-1 SCROLL CAPS