# EM3188 Android5.1 User Manual

**V1.0** 



**Boardcon Embedded Design** 

www.boardcon.com



### 1. Introduction

#### 1.1. About this Manual

This manual is intended to provide the user with an overview of the board and benefits, complete features specifications, and set up procedures. It contains important safety information as well.

#### 1.2. Feedback and Update to this Manual

To help our customers make the most of our products, we are continually making additional and updated resources available on the Boardcon website (<u>www.boardcon.com</u>, <u>www.armdesigner.com</u>). These include manuals, application notes, programming examples, and updated software and hardware. Check in periodically to see what's new!

When we are prioritizing work on these updated resources, feedback from customers is the number one influence, If you have questions, comments, or concerns about your product or project, please no hesitate to contact us at <a href="mailto:support@armdesigner.com">support@armdesigner.com</a>.

#### 1.3. Limited Warranty

Boardcon warrants this product to be free of defects in material and workmanship for a period of one year from date of buy. During this warranty period Boardcon will repair or replace the defective unit in accordance with the following process:

A copy of the original invoice must be included when returning the defective unit to Boardcon. This limited warranty does not cover damages resulting from lighting or other power surges, misuse, abuse, abnormal conditions of operation, or attempts to alter or modify the function of the product.

This warranty is limited to the repair or replacement of the defective unit. In no event shall Boardcon be liable or responsible for any loss or damages, including but not limited to any lost profits, incidental or consequential damages, loss of business, or anticipatory profits arising from the use or inability to use this product.

Repairs make after the expiration of the warranty period are subject to a repair charge and the cost of return shipping. Please contact Boardcon to arrange for any repair service and to obtain repair charge information.



## **Revision History**

Ver	Description	Author	Date
V1.0	Initial released Version	Zhao Linhai Ao Juncheng	2017-07-04



### Content

1 EM3188 Introduction	4
2 Compiler Environment	5
2.1 Vmware7.0+ubuntu12.04	5
2.2 Install Compiler	5
2.3 Install Tools	6
3 Compile Source	6
3.1 Compile u-boot	6
3.2 Compile Kernel	6
3.3 Compile Android	7
4 Pack Update.img	7
5 Install Driver	8
5.1 Install USB-to-UART	8
5.2 Install SecureCRT	8
5.3 Install Rockchip Driver Assistant	10
6 Burn Images	
7 Ubuntu Application	14
7.1 Debug Serial Terminal	14
7.2 LCD Panel and HDMI Dual Display	14
7.3 SD Card	15
7.4 USB Host	16
7.5 Video Player	16
7.6 Ethernet	18
7.7 Record	18
7.8 RTC	20
7.9 Wi-Fi	22
7.10 3G Module	23
7.11 Camera	23
7.12 GPS	25
7.13 RS485	26
7.14 UART2	28
7.15 CAN	
7.16 Buzzer	
7.17 GPIO	31
7.18 LEDs	



# **1 EM3188 Introduction**



Feature	Specifications					
CDU	Rockchip RK3188, Quad-Core ARM Cortex-A9, up to 1.6GHz					
CPU	28 nm HKMG process					
	Quad-Core Mail-400MP4 GPU, support OpenGL ES1.1/2.0					
GPU	High performance dedicated 2D processor					
Memory	1GB DDR3					
Flash	4GB eMMC Flash					
Power	12V/2A					
Ethernet	10/100M, RJ45 interface					
USB	2x USB2.0HOST, 1x USB2.0 OTG					
CAN	1x CAN. 2pin connector.					
RS485	1x RS485. 3pin connector.					
HDMI	HDMI V1.4, support 1080P					
	2-CH UARTs.					
UART	DUART: DB9_top/4-pin connector, for debug.					
	UART2: DB9_bottom.					
SD card	1x Micro SD card slot					
RTC	Real Time Clock, powered by external lithium battery					
Audio	Microphone, MIC, Speakers					
	2x 40-pin TTL_LCD connector for 4.3-,7-inch Cap-touch panel;					
	1x 26-pin LVDS for 10.1-inch HD Cap-touch panel.					
GPIO	1x 26-pin header					
Button	Recover, Power					



WiFi	2.4GHz WiFi, support 802.11 b/g/n
Camera	24PinFPC connector. OV5640 model,5 Megapixels.
GPS	ST-97-U7 MODEL, ublox 7 chipset
3G(optional)	PCI-E connector, U20 model.
Dimension	Baseboard - 161.0 x 116.0 mm; CPU board - 67.0 x 51.0mm

# 2 Compiler Environment

### 2.1 Vmware7.0+ubuntu12.04

Install Vmware7.0 in windows OS, and then install ubuntu12.04 in VMware to compile. Please refer to the official website http://www.ubuntu.com/ to download and install Ubuntu system. Note: Ubuntu 64bit OS is recommended.

# 2.2 Install Compiler

Install JDM steps

Step 1, Copy the file (Path: Tools\ jdk-7u80-linux-x64.tar.gz) to the Ubuntu system and unzip. # sudo mdir /usr/lib/java # sudo tar zxvf jdk-7u80-linux-x64.tar.gz –C /usr/lib/java/ Step 2, Add the following information in the end of "/etc/profile": export JAVA\_HOME=/usr/lib/java/jdk1.7.0\_80 export JRE\_HOME=/usr/lib/java/jdk1.7.0\_80/jre export CLASSPATH=.:\$JAVA\_HOME/lib:\$JRE\_HOME/jre/lib:\$CLASSPATH export PATH=\$JAVA\_HOME/bin:\$JRE\_HOME/jre/bin:\$PATH

#### # source /etc/profile

*Step 3*, Enter command to check if the JDK has been installed successfully and check the revised version.

#### # java -version 🔚 192.168.0.121 - SecureCRT File Edit View Options Transfer Script Tools Window Help 🖏 況 🎧 🎲 🕷 Enter host <Alt+R> | 🗅 🛍 🗛 | 🖕 😓 🦪 | 🚰 💥 📍 | 🞯 | 🗷 ✓ 192.168.0.121 × ⊲ ⊳ zhaolinhai@boardcon:~\$ java -version java version "1.7.0.80" Java(TM) SE Runtime Environment (build Java HotSpot(TM) 64-Bit\_Server VM (bui \_80-b15) . 0 (build 80-b11. mixed mode) Ready ssh2: AES-256-CTR 5, 24 6 Rows, 88 Cols VT100 CAP NUM



## 2.3 Install Tools

# sudo apt-get install build-essential

- # sudo apt-get install zlib1g-dev
- # sudo apt-get install flex
- # sudo apt-get install libx11-dev
- # sudo apt-get install gperf
- # sudo apt-get install libncurses5-dev
- # sudo apt-get install bison
- # sudo apt-get install lsb-core
- # sudo apt-get install lib32z1-dev
- # sudo apt-get install g++-multilib
- # sudo apt-get install lib32ncurses5-dev
- # sudo apt-get install uboot-mkimage
- # sudo apt-get install g++-4.4-multilib

# **3 Compile Source**

Under the Windows unzip the CD files below.

boardcon\_3188mid\_v2.tar.7z.001 boardcon\_3188mid\_v2.tar.7z.002 boardcon\_3188mid\_v2.tar.7z.003

Copy the Source em3188mid.tar.bz2 to the ubuntu system and unzip.

# tar xvf em3188mid.tar.bz2

# cd em3188mid

All sources in em3188mid directory.

# 3.1 Compile u-boot

The u-boot not need to compile. u-boot path: AndroidTool\_Release\_V2.35/rockdev/RK3188Loader(L)\_V2.31.bin

## 3.2 Compile Kernel

Enter the following command to compile the kernel: # cd em3188mid /kernel/ # make rk3188\_defconfig # make kernel.img Kernel.img is generated in **em3188\kernel** directory.



## 3.3 Compile Android

Enter the follow command to Compile Android:

# cd .. (Enter em3188mid directory)

# source build/envsetup.sh

# make –j4

# ./mkimage.sh

(Generate images files)

Images are generated in em3188\rockdev\Image-rk3188 directory

# 4 Pack Update.img

#### Step 1, unzip RK3188\_5.1\_AndroidTool\_Release\_v2.35.zip in windows.

*Step 2*, copy **boot.img**, **misc.img**, **recovery.img** and **system.img** in *rockdev/Image-rk3188* of the Android root directory and **kernel/kernel.img** of the Android root directory to the development tools *rockdev/Image* directory.

*Step 3*, enter *RK3188\_5.1\_AndroidTool\_Release\_v2.35\rockdev* directory, then double-click to run mkupdate.bat.

update.img will be generated in RK3188\_5.1\_AndroidTool\_Release\_v2.35\rockdev directory.





# **5 Install Driver**

# 5.1 Install USB-to-UART

Plug the **USB-to-UART cable CP2102** to the PC, unzip **CP2102WIN7.rar** on Windows, then click **preInstaller.exe** to install



Now the device will be listed under Device Manager -> PORTS with unique serial port assigned

CP210x USB to UART Bridge Controller (COM5)

### 5.2 Install SecureCRT

The serial terminal SecureCRT is used for debugging. It can be used directly after decompression.

Open SecureCRT.exe after copy to PC (path: *tools\windows\SecureCRT.exe*), then click the icon **Quick Connect** to config.



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File Edit Vie	ew Options Transfer Script Tools Help	
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<ul> <li>✓ Passwor</li> <li>✓ PublicK</li> <li>✓ Keyboar</li> <li>✓ GSSAPI</li> <li>✓ Show quic</li> </ul>	d ey d Interactive & connect on star & Connect Cancel	

Set the parameters as follow: **Protocol**: Serial **Port**: To be specified by user PC **Baud rate**: 115200 **Please check XON/XOFF but not RTS/CTS** Check Save session



Quick Connect		X
Protocol: Port: Baud rate: Data bits: Parity: Stop bits:	Serial  COM2 115200 8  None 1	User COM Port number Flow Control DTR/DSR RTS/CTS XON/XOFF
🔲 Show quick	connect on star	✓ Save session ☐ Open in a tab Connect Cancel

After all, click connect

**Illusion**: If open more than one serial terminal tools, and they use the same serial port, there will be reported **the port is busy**.

Solution: Turn off the serial tool that unnecessary.

## 5.3 Install Rockchip Driver Assistant

Path: Release\_DriverAssitant/DriverInstall.exe

RK Driver Assitant	<b>—</b> ×
Install Driver	hinstall Drive



S RK Dr	iver Assitant	×
2	Install Driver	hinstall Drive

After the installation is complete, connect the board and PC with Micro USB cable, then power on, in *Computer Management* can see the following information:

# 6 Burn Images

Step 1, open AndroidTool\_Release\_v2.35/AndroidTool\_Release\_v2.35/AndroidTool.exe

*Step 2,* Copy the *kernel/kernel.img* and Android root directory *rockdev/Image-rk3188/* **boot.img**, **misc.img**, **recovery.img** and **system.img** to *AndroidTool\_Release\_v2.35/rockdev/Image/*.

#		Address	Name	Path	
1	•	0x00000000	Loader	\rockdev\RK3188Loader(L)_V2.31.bin	
2		0x00000000	Parameter	\rockdev\parameter=rk3188	
3	•	0x00002000	Misc	\rockdev\Image\misc.img	
4	•	0x00004000	Kernel	\rockdev\Image\kernel. img	
5	◄	0x0000A000	Boot	\rockdev\Image\boot.img	
5	◄	0x00010000	Recovery	\rockdev\Image\recovery.img	
7	◄	0x00288000	System	\rockdev\Image\system.img	
		/er:2.31	Pure		

*Step 3,* connect the EM3188 and PC with the USB OTG cable, press the recover button and power on until the windows shows **Found one LOADER Device.** 







Andr	oidT	ool v2.35	-			
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			No De	evices Found	Download system (100%) Check system (100%) Download image OK	-

After download finished, the board will reboot automatically.

If want to download the update.img, click Upgrade Firmware -> Firmware -> select update.img

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which ad image operate firmware Advanced Function	
Firmware Upgrade Switch FraseFlash	
Fw Ver: 4.4.02 Loader Ver: 2.31 Chip Info: RK31	
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# 7 Ubuntu Application

# 7.1 Debug Serial Terminal

Connect the board and PC with USB Serial cable, then power on, the terminal will output startup information.

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# 7.2 LCD Panel and HDMI Dual Display

Connect LCD panel and HDMI-OUT as below, then Power on EM3188 board, the LCD panel and HDMI dual display as shown in the following figure.





# 7.3 SD Card

Insert SD card into SD card interface when system is running, system will automatically mount the SD card. You can view pictures in the SD card through picture browser. Play video in the SD card through video player, or view the files in SD card through **Explorer** as follow:



### Click "SD Card":

• • •				2	8:52
Explorer					
🛖 Home	💽 LevelUp	🚍 Multi	🔀 Editor	RewFolder	
🍵 Internal Me	emory				
→ SD Card					
⊜ USB					

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<b>U</b> <sup>2</sup>	~	0	L. (1)	
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### 7.4 USB Host

The USB Host can be used to connect USB mouse, USB keyboard, U-Disk or other USB devices.

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### 7.5 Video Player

Put some MP4 files to the U disk and insert to the development board. Star up and run Gallery or Video to play.



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# 7.6 Ethernet

Connect the Board and router with an Ethernet cable (default DHCP=Yes). User can ping URL/IP at terminal, or open the browser to test Network.



## 7.7 Record

Open the recorder app to test recording



View the record file:



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	SD card		
	💩 USB storage		
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	NAND FLASH		- 12,191 W
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	Ringtones	2011-0	1-01 12:02:12   c
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	recording25300	0 <b>2176.amr</b> 6.87 K   2011-	01-01 12:22:12
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# 7.8 RTC

The RTC is used to ensure the date and time is still able to work after power off.





Enter command in command line to view the RTC.

# busybox1.11 hwclock



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File	Edit	View	Options	Transfer	Script	Tools	Window	Help			
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Ready		Se	erial: COM	L, 115200	12, 18	12 Rov	ws, 74 Cols	5 VT100		CAP	NL

### 7.9 Wi-Fi

Connect the WiFi antenna, then click **Settings -> WiFi -> turn on**, select the SSID from the list of available networks and enter the password.

After connected, user can open the browser to browse the web.





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### 7.10 3G Module

- Step 1, Install 3G module (UC20) on PCI-E slot;
- Step 2, Connect antenna and insert SIM card;
- Step 3, Power on RK3188 board;
- Step 4, Open Internet Browser to browse the Web.



### 7.11 Camera

Connect the camera module (OV5640) to the development board **before power on**, then click the camera app to test.







Click the button to take photo or video.







## 7.12 GPS

Connect GPS antenna, then power on and install the APP GPS\_test1.2.4.apk Open GPS-Test icon to test.





## 7.13 RS485

*Step1*.Connect the EM3188 RS485 port and PC with USB-to-RS485 device (A B reverse connection).



The PC will report that found new hardware.

User can check whether the driver is installed successfully (Computer -> Device manager -> Port)



▲ ⑦ 端口 (COM 和 LPT) Prolific USB-to-Serial Comm Port (COM3) ③ ⑦ USB-SERIAL CH340 (COM9) ③ ⑦ 打印机端口 (LPT1) ◎ ⑦ 通信端口 (COM1)

Step2. open another SecureCRT and set the parameters as follow.

Protocol: Serial Port: USB-RS485 Baud rate: 9600

*Step3*.Connect Board A and computer with the USB-RS485 and Set the corresponding serial port (COM 9) as below.



Execute the command at Board A serial terminal.

# OUT\_IO\_NUMBER=183 # echo \${OUT\_IO\_NUMBER} > /sys/class/gpio/export

Set the gpio183 as output port.

# echo "out" > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/direction

Set Board B as Transmitter.

Then in the PC SecureCRT will receive 12345678. # echo 0 > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value # echo 12345678 > /dev/ttyS0

Set Board B as receiver.

The Transmitter and receiver can be converted by execute the command # echo 1> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value # cat /dev/ttyS0





## 7.14 UART2

For an example, we test the communication of EM3188 board's UART2 and PC's com5. The is Baud rate 9600.

*Setp1*, connect EM3188 board's Debug serial terminal to PC. *Setp2*, connect EM3188 board's UART2 to PC.



Setp3, execute the command in the Debug serial terminal of EM3188 board

#### Send data:

# echo abcdefgh > /dev/ttyS1

Receive data:

# cat /dev/ttyS1

🕞 serial-com1 - Sec	ureCRT	-		_		• ×
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< serial-com1 🗙	؇ serial-com5					⊲ ⊳
chg=a5.399897] shell@rk3188:/ shell@rk3188:/ chg=a@rk3188:/ shell@rk3188:/ shell@rk3188:/ shell@rk3188:/ shell@rk3188:/ shell@rk3188:/ chg=a5.399475] 87654321 hgfedcba 87654321	healthd: # # [ 125.399624 # # echo abcdefg # echo 1234567 # echo 1234567 # echo 1234567 # cat /dev/tty: healthd:	5] heal 1> /dev 3 > /dev 3 > /dev 3 > /dev	thd: v/ttys1 v/ttys1 v/ttys1 v/ttys1 Receiver	ransmitte	r	A H
Ready Se	erial: COM1, 115200	17, 1	26 Rows, 75 Cols	VT100	С	AP NUN

Setp4, you can enter the Send data directly in the COM5 of your PC as below.







### 7.15 CAN

Install the USB ADB Tool and push the test program can\_server and can\_client to EM3188 board:

# adb root

# adb remount

# adb push can\_server /system/bin

# adb push can\_client /system/bin

# adb shell

# cd system

# cd bin

# chmod 777 can\_server

# chmod 777 can\_client

start can0

# ifconfig can0 down# ip link set can0 type can bitrate 125000# ifconfig can0 up

board A(send data)

# ./can\_client
can0 can\_ifindex = 4
Send a CAN frame from interface 4

board B (receive data)

# ./can\_server

can0 can\_ifindex = 4 ddReceived a CAN frame from interface 0 frame message --can\_id = 123 --can\_dlc = 5 --data = hello Received a CAN frame from interface 4

# 7.16 Buzzer

Execute the command at EM3188 serial terminal: # OUT\_IO\_NUMBER=284 # echo \${OUT\_IO\_NUMBER} > /sys/class/gpio/export

Set the gpio284 as output port: # echo "out" > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/direction

Execute the follow command to buzzer: buzzer turn on: # echo 1> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value



#### buzzer turn off:

# echo 0> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

# 7.17 GPIO

Set GPIO0\_B7(OUT\_IO\_NUMBER=175) to be an **output** port for example.

# OUT\_IO\_NUMBER=175

# echo \${OUT\_IO\_NUMBER} > /sys/class/gpio/export

# echo "out" > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/direction

Assign value=1

# echo 1> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

Assign value= 0

# echo 0> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

Set GPIO0\_B7 to be an **input** port.

# OUT\_IO\_NUMBER=175

# echo \${OUT\_IO\_NUMBER} > /sys/class/gpio/export

# echo "in" > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/direction

# cat /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

#### List of GPIOs

Pin Name	GPIO	OUT_IO_NUMBER
BL_EN	GPIO0_A2	162
DC_DET	GPIO0_B2	170
ALRT_N	GPIO0_B1	169
GPIO0_A1	GPIO0_A1	161
GPIO0_A3	GPIO0_A3	163
GPIO0_A5	GPIO0_A5	165
LCD_EN	GPIO0_B0	168
GPIO0_B4	GPIO0_B4	172
GCENSOR_INT	GPIO0_B7	175
CHG_DET	GPIO0_A6	166
SPI0_CLK	GPIO1_A6	198
SPI0_CSN0	GPIO1_A7	199
GPIO0_C3	GPIO0_C3	179
GPIO0_C4	GPIO0_C4	180
GPIO0_C2	GPIO0_C2	178
GPIO0_C6	GPIO0_C6	182
UART3_RTSN	GPIO1_B5	205
UART3_CTSN	GPIO1_B4	204
SDMMC0_RSTN	GPIO3_A0	256
UART0_RTS	GPIO1_A3	195
COMP_INT	GPIO3_D7	287



# 7.18 LEDs

Turn on/off the LED20(OUT\_IO\_NUMBER=172) for example. # OUT\_IO\_NUMBER=172 # echo \${OUT\_IO\_NUMBER} > /sys/class/gpio/export # echo "out" > /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/direction

#### LED turn on

# echo 1> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

#### LED turn off

# echo 0> /sys/class/gpio/gpio\${OUT\_IO\_NUMBER}/value

LED_NAME	GPIO	OUT_IO_NUMBER					
LED17	GPIO0_A1	161					
LED18	GPIO0_A3	163					
LED19	GPIO0_A5	165					
LED20	GPIO0_B4	172					

### List of LEDs