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SPECIFICATION
FOR
M3 TFT

MODULE NO: AFA240400M-3.0-A8-TP
REVISION NO: 00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
CHECKED BY		
APPROVED BY		

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M3 TFT is target to the users updating their product from monochrome LCD to TFT displays or new products fast developing, our solution can provides a simple and reliable way to control TFT displays. M3-M series include small screen with CPU port from 2.3” to 3.5” as well as screen with RGB port from 3.5” to 7”, meeting the requirements for various applications from customers.

1.0 General Description

1. The bottle neck of MCU speed is solved: compared with the black and white module, the data volume of color screen is much larger and require rapid data refresh while updating interface, which cannot be satisfied by traditional MCU, otherwise the responding speed of whole system will be very slow.
2. The data storage space of common MCU is within 64K, which is not enough to store one picture for TFT displays; our module adopts an 2Mbyte-8Mbyte FLASH to store picture data and this is quite enough for common interface design.
3. The technology of TFT displays change quickly and the driver IC updating fast, the product life time can’t be guaranteed. The software and hardware is required to change often in order to adopt the new displays, which brings a lot of extra work. Our solution can help customer to solve the problem, when there is screen change, we can adopt it on our mainboard, the consumer don’t need to changing their software and hardware.
4. The adoption of alphabetic string command for module control is simple and clear; only need MCU output “Hello World” from the UART
5. The RAM on the module is virtualized as a USB flash disk, the user copy pictures from computer to the module, saving a lot of work like general modeling and compiling etc. and development time is shortened.

2.0 Electrical Characteristics

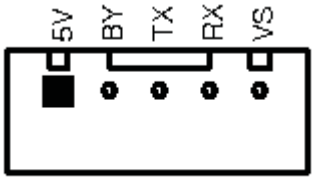
Item	spec	Note
Input voltage	5V±5%	
Current	<180mA	Backlight on
Color	65K colors	
Operating Temperature	-20----70℃	
Storage Temperature	-30----80℃	
Luminance	300cd/m²(type)	
Display Mode	Transmissive	

3.0 Mechanical Parameters (mm)

Item	spec	Note
LCD Size	77.00*45.04	240*400 Dots
Module Size	85.80*58.90*13.0 (max)	
VA Size	66.50*40.50	

4.0 Pin Definition

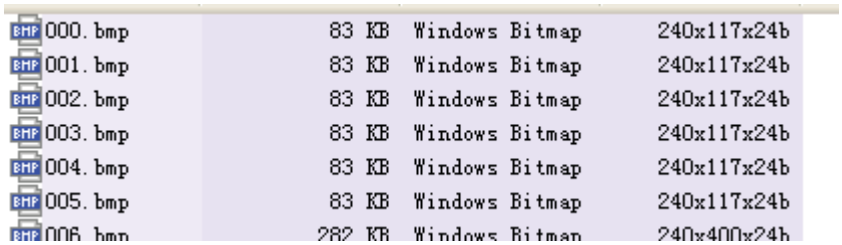
J1 on module is communication port, K1 is reset key.



5.0 Interface Design

1. Put all the required pictures to the folder BMP_FILE, convert them into BMP format by software “ACDsee” and rename picture names in proper sequence from 000.BMP. see Appendix I.

The pictures are managed in a proper sequence like below:



2. Three files generated in BMP_DATA after execute “MakeDAT.bat”: BMPDATA.BIN is the data file to put all the pictures; TABLE.BIN is table file also used as an index file. Copy these two files into the virtual folder on module, then the user can use them. There are pictures’ serial number and corresponding size in the file of BmpDataBin.h as a reference to user, which is unnecessary to be copied into USB flash disk.

3. Special fonts like Chinese or Japanese is also can be extracted by a special software.
Rename the extracted font library file and copy it into USB flash disk for use; the file name should be changed as HZK.BIN.

4. Note: the USB flash disk is a virtualized disk, please use FAT12 to format the USB flash disk (this is the default format in WinXP) in order to convenience the user to use this module and increasing the picture refreshing speed. The limit number of files in root directory is 16, generally there are only font file, table file and data file; a new folder need to be created if other files need to be stored by user
5. Press K1 (reset key) on the module after all files are copied into USB flash disk.

6.0 Control Command

This module adopts alphabetic string to control all operations.
Display LOGO when Power on, then display the pictures in USB flash disk automatically if there is no further operation in 3 seconds.
The command format begins with command word, continued with parameter list, parameters are separated by space and ends with a return key (Must);
When the command is executing, the busy pin is low, the module can’t receive any new command until the busy pin is high.
e.g: “CMD n1 n2……, then Press Return Key”
The parameters n1, n2… like table below meaning a 16-bit non symbol integer data and s1, s2…meaning alphabetic string.

Drawing commands

Function	Command Format	Example	Time
Browse Pictures	ALL	"ALL\n"	-
Draw a circle	CIRCLE Xa Ya R C	"CIRCLE 100 100 50 31\n"	4ms
Fill in color	CLR Xa Ya Xe Ye C	"CLR 0 0 100 100 31\n"	5ms
Clear screen	CLS C	"CLS 31\n"	28ms
Cut a picture	CUT Pn Xa Ya Xb Yb Xs Ys	"CUT 1 30 30 0 0 100 100\n"	20ms
Draw a dot	DOT Xa Ya C	"DOT 100 100 31\n"	0.12ms
Draw a frame with a fillet	FRAME Xa Ya Xe Ye Ds Do C	"FRAME 10 10 200 40 2 3 31\n"	4ms
Draw a line	LINE Xa Ya Xe Ye C	"LINE 10 10 50 50 31\n"	0.7ms
Backlight on	LEDON	"LEDON\n"	4us
Adjusting backlight luminance	LEDON X (X:1~10)	"LEDON10\n"	4us
Backlight off	LEDOFF	"LEDOFF\n"	4us
Flash on	MOT Xa Ya Ps Pe Pt	"MOT 0 0 10 14 100\n"	0.15ms
Flash off	MOFF	"MOFF\n"	4us
Display Picture	PIC Pn Xa Ya	"PIC 1 30 30\n"	125ms
Draw a rectangle	RECT Xa Ya Xe Ye C	"RECT 10 10 100 100 31\n"	5ms
Screen size *	SIZE	"SIZE\n"	13ms
Display alphabetic string	STR Xa Ya C Str	"STR 0 0 31 ABCDEF\n"	0.8ms/Char
Display alphabetic string with background color	STB Xa Ya C Cb Str	"STB 0 20 65535 31 ABC\n"	30us/Char

Note:

Xa Ya : Start x y coordinates
Xe Ye : End x y coordinates
C :color(16bits,RGB 565)
Cb : Background color

Xb Yb : start X Y coordinates in big Picture
Xs Ys : intercepted size

Ds Do :Length of Solid line/Dashed line
Str :alphabetic string(8x16)
Pn : Pictures serial number(000-999)
R : Radius
Ps : Start picture for flash
Pe : End picture for flash
Pt : Spacing time(step :100ms)

* Using the command to get the size of picture, a return value format "SXY Xsize Ysize\n" will be received

Configure Commands

Function	Command Format	Example	Time
Set baud rate	BAUD b1 b2	"BAUD 9600 9600\n"	20ms
Demonstrate PIC	DEMO Dt Xa Ya	"DEMO 1000 0 0\n"	20ms

Demonstrate off	DMOFF	"DMOFF\n"	20ms
Change display direction	TURN Tn	"TURN 90\n"	140ms

Note:

b1 b2: baud tate (range:2400,4800,9600,19200,38400,56000,57600,115200)

Dt: DEMO interval(step 100ms) Tn: Rotation angle (0°, 90°)

Touch Commands (only apply to the module with Touch Panel)

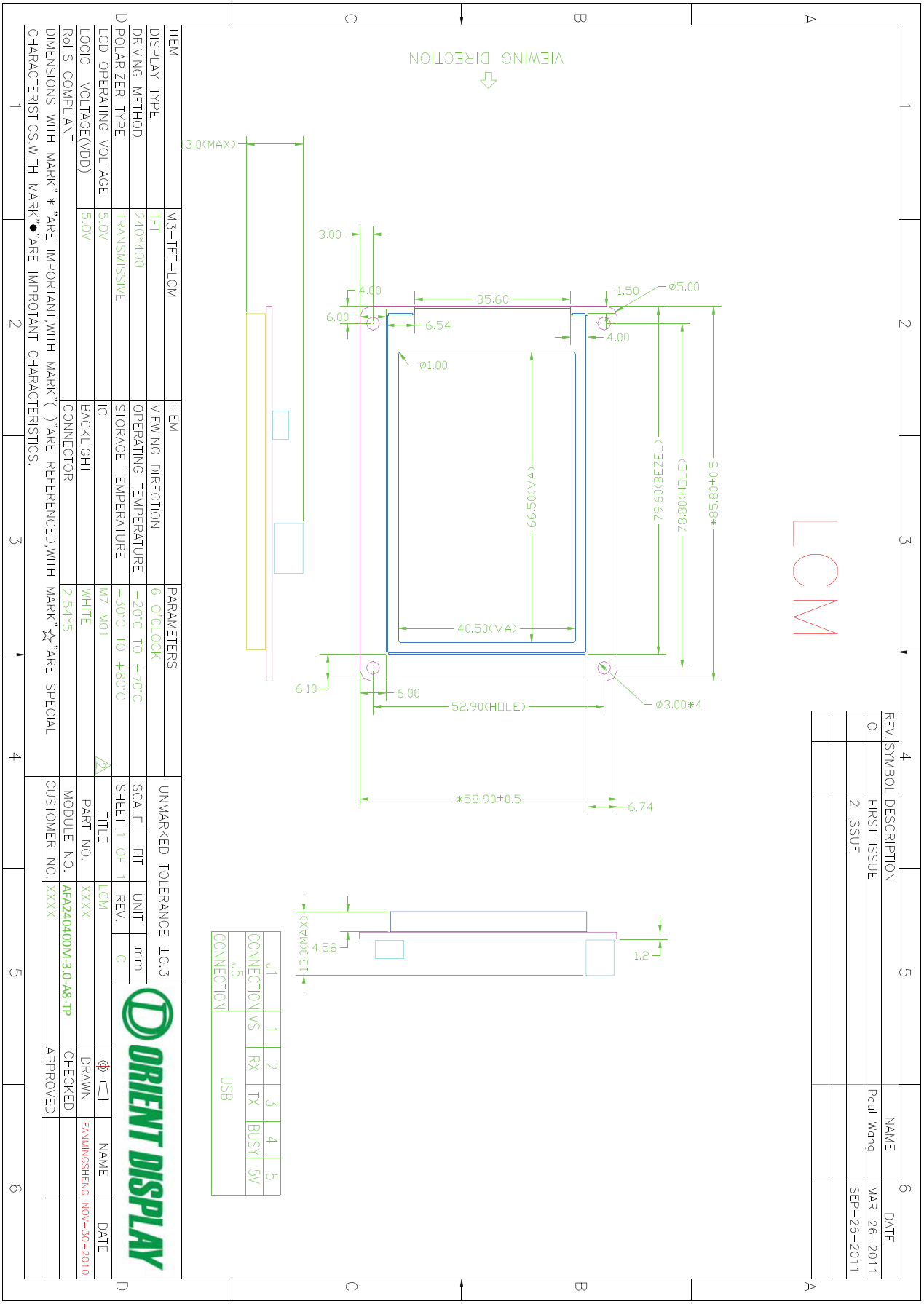
Function	Command Format	Remark
TP calibration*	"TPADJ\n"	Calibration TP, users click four dots one by one in screen.
Mode 1 /TP Response	"TPM1\n"	, return data of coordinate every 30ms when click TP
Mode 2 /TP Response	"TPM2\n"	return data of coordinate when clicked TP each time (default)
Test TP	"TPTEST\n"	Test TP.
Stop test TP	"TPTOFF\n"	Stop test touch panel

Note:

The data format after click on TP "TXY Xaddr Yaddr \ n"

* If the display direction is adjusted, must re-calibrate TP

7.0 Outline Drawing



8.0 User's Guide

Appendix I

Manage pictures by software "ACDsee"

1. Copy the pictures to BMP File

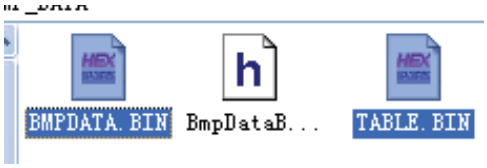
2. Convert all files into BMP format.

3. Rename all the pictures, start from 001.

4. The file name for the same group should be named in sequence.

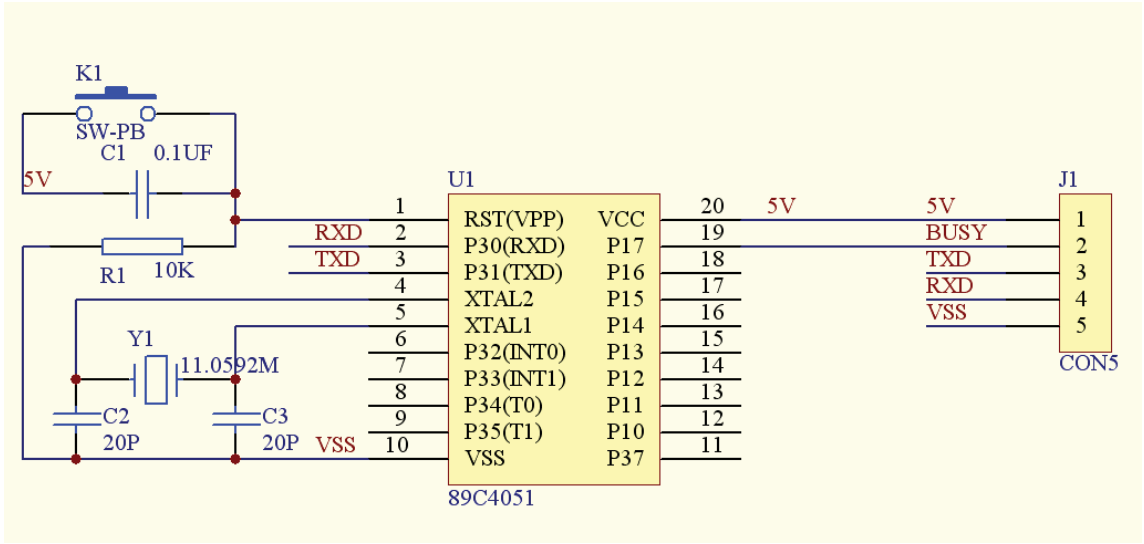
5. Execute "MakeDAT.bat"

6. Three files generated in BMP_DATA after execute "MakeDAT.bat": BMPDATA.BIN is the data file to put all the pictures; TABLE.BIN is table file also used as an index file. Copy these two files into the virtual folder on module, then the user can use them. There are pictures' serial number and corresponding size in the file of BmpDataBin.h as a reference to user, which is unnecessary to be copied into USB flash disk.

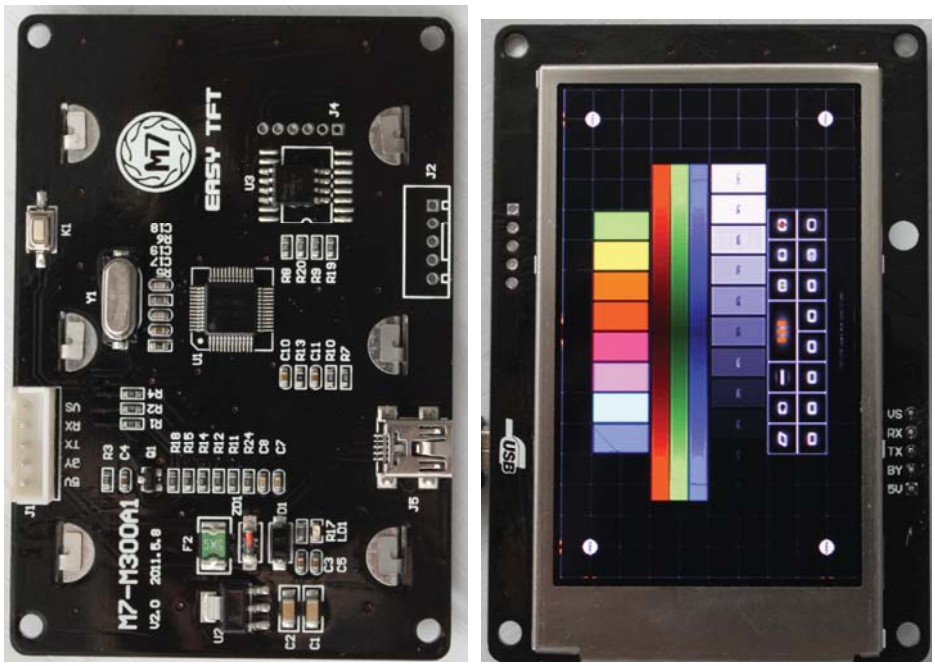


Appendix II

Block Diagram



Appendix III



No	Item	Condition	Quantity
1	High Temperature Operation	50℃, 96Hrs	5
2	Low Temperature Operation	0℃, 96Hrs	5
3	High Temperature & Humidity	60℃, 90%RH, 96Hrs	5
4	High Temperature Storage	80℃, 96Hrs	5
5	Low Temperature Storage	-40℃, 96Hrs	5
6	Temperature Cycle	-20℃, 30min~70℃, 30min, 20 cycles.	5

9.0 Reliability Test Items

Note . No cosmetic and function defects after test.

10.0 Package Specification

TBD