APPLICATION NOTE – REFERENCE DESIGN

MODEL NAME：5.65inch e-Paper (F)

1 About This Application Note

This document describes a reference design system that integrates the N-Color 5.65” display (7 colors). It includes an application circuit, timing information, pin assignments and software programming guide for the ePaper display module.

2 Overview

This 5.65” N-color display is a 600x448 ePaper display with integrated timing control and power management circuitry. Each pixel on the display has the capability of showing seven states – black, white, blue, orange, yellow, green and red. The N-Color 5.65” panel is ideal for applications such as signage for retail pricing with the ability to highlight promotions with other 5 colors, blue, orange, yellow, green and red.

3 Device Interface

This section describes the interface and pin assignments of the N-Color 5.65” panel.

Table 1 Pin descriptions for N Color

Pin Assignment				
Pin#	**Type**	**Signal**	**Description**	**Remark**
1	I	MFCSB	MCU to flash/EEPROM chip select	
2	O	GDR	N-Channel MOSFET Gate Drive Control	
3	O	RESE	Current sense input for the control loop	
4	P	VSL_LV	Negative source driver voltage (low voltage)	
5	P	VSH_LV	Positive source driver voltage (low voltage)	
6	O	TSCL	I2C interface to digital temperature sensor Clock pin	
7	I/O	TSDA	I2C interface to digital temperature sensor Data pin	
8	I	BS1	Bus selection pin; L: 4-wire IF. H: 3-wire IF (Default)	
9	O	BUSY	Busy state output pin	
10	I	RES#	Reset	
11	I	D/C #	Data / Command control	
12	I	CS #	Chip select input pin (SPI)	
13	I	SCL	Serial clock pin (SPI)	
14	I/O	SDA	Serial data pin (SPI)	
15	P	VDDIO	Power for interface logic pins	
16	P	VCI	Power supply pin for the chip	
17	P	VSS	Ground	
18	P	VDD	Core logic power pin	
19	O	FMSDO	Flash/EEPROM to MCU data output	Don’t share this pin with SDA of SPI.
20	P	VSH	Positive source driving voltage	
21	P	VGH	Positive gate driving voltage	
22	P	VSL	Negative source driving voltage	
23	P	VGL	Negative gate driving voltage	
24	P	VCOM	VCOM driving voltage	

I: Input Pin; O: Output Pin; I/O: Input/Out Pin; P: Power Pin

3.1 SPI Interface Timing

Figure 1 3-wire SPI Timing Diagram

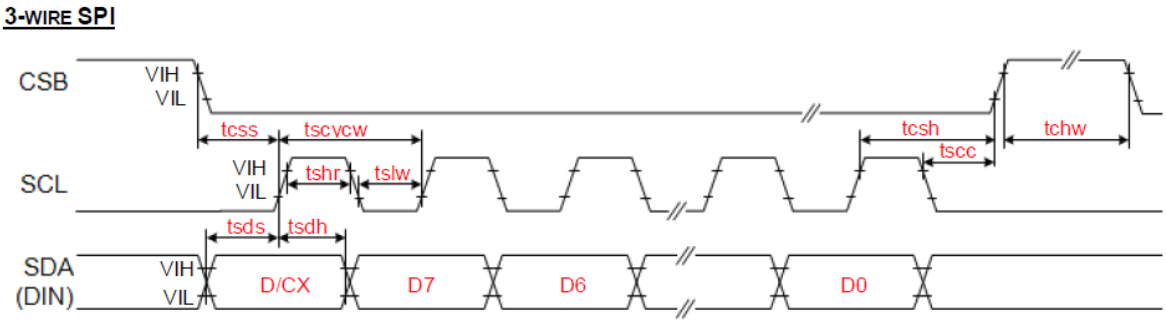


Figure : 3-wire Serial Interface – Write

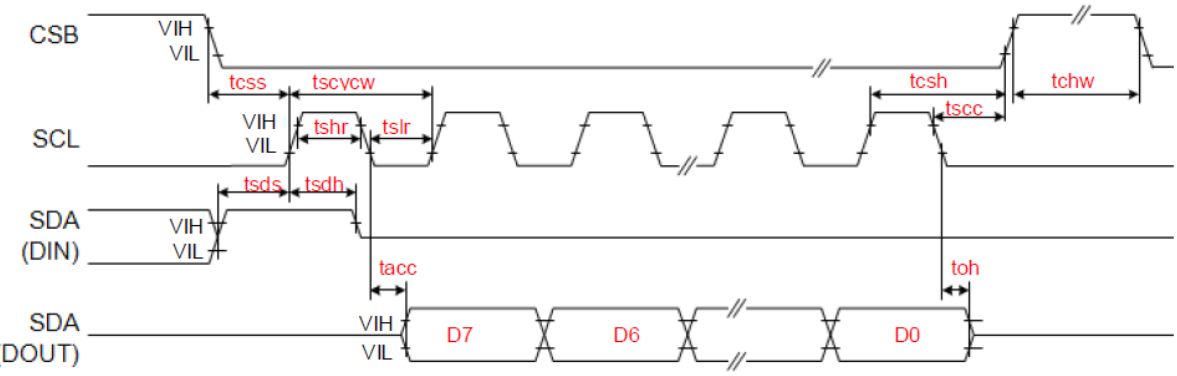


Figure : 3-wire Serial Interface – Read

Figure 2 Host Communications Timing Diagram

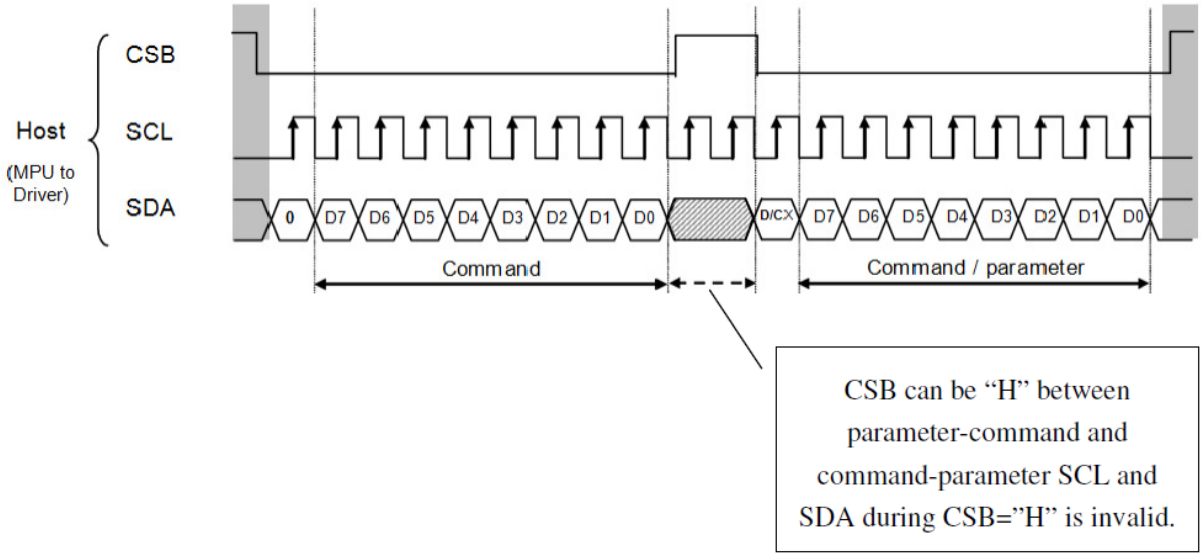


Figure 3 4-wire SPI Timing Diagram

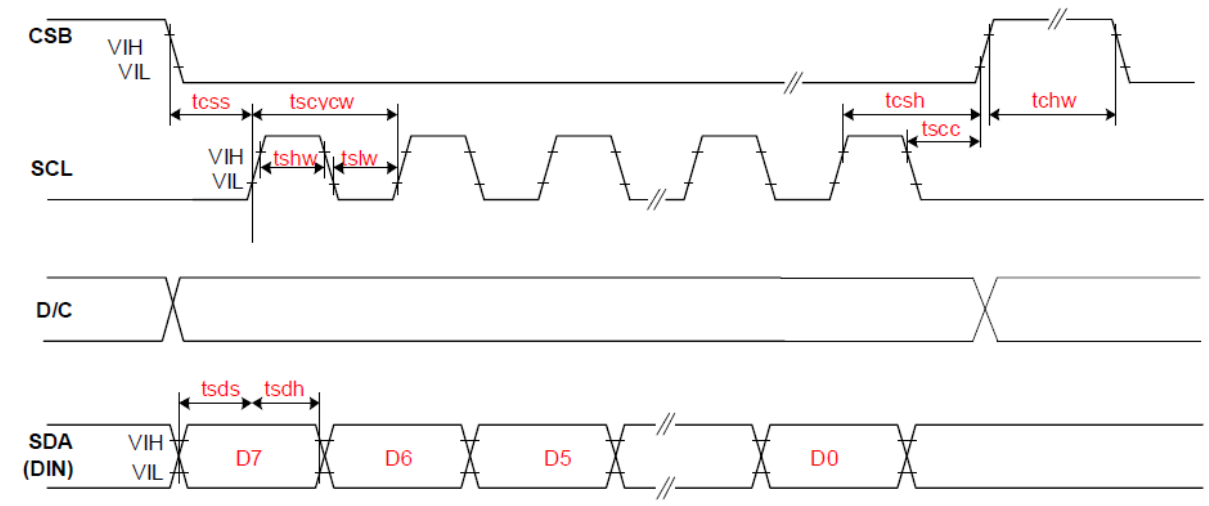


Figure : 4-wire Serial Interface – Read

Figure 4 Host Communications Timing Diagram

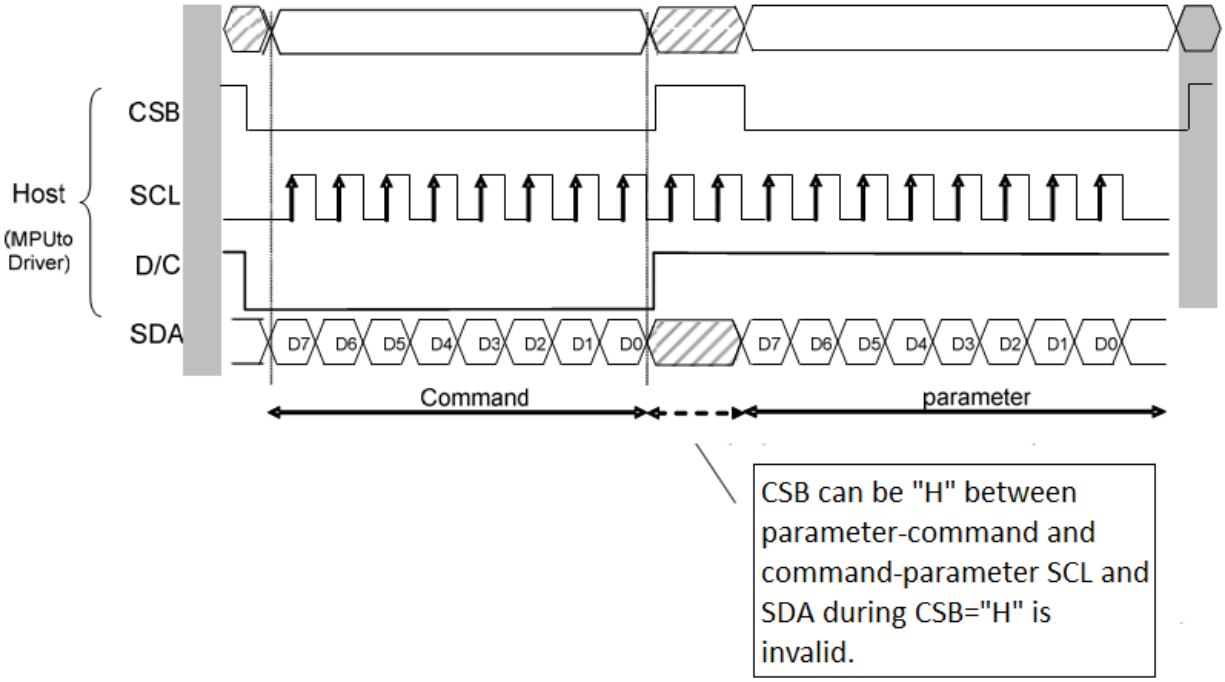


Table 2 Timing Table

Symbol	Signal			Min	Typ	Max	Unit
SERIAL COMMUNICATION							
tCSS	CSB	Chip select setup time		60			ns
tCSH		Chip select hold time		65			ns
tSCC		Chip select setup time		20			ns
tCHW		Chip select setup time		40			ns
tSCYCW	SCL	Serial clock cycle (Write)		100			ns
tSHW		SCL “H” pulse width (Write)		35			ns
tSLW		SCL “L” pulse width (Write)		35			ns
tSCYCR		Serial clock cycle (Read)		150			ns
tSHR		SCL “H” pulse width (Read)		60			ns
tSLR		SCL “L” pulse width (Read)		60			ns
tSDS	SDA (DIN) (DOUT)	Data setup time		30			ns
tSDH		Data hold time		30			ns
tACC		Access time		10			ns
tOH		Output disable time		15			ns

4 Reference circuit

Figure 5 N-Color 5.65” Reference Circuit (TBD)

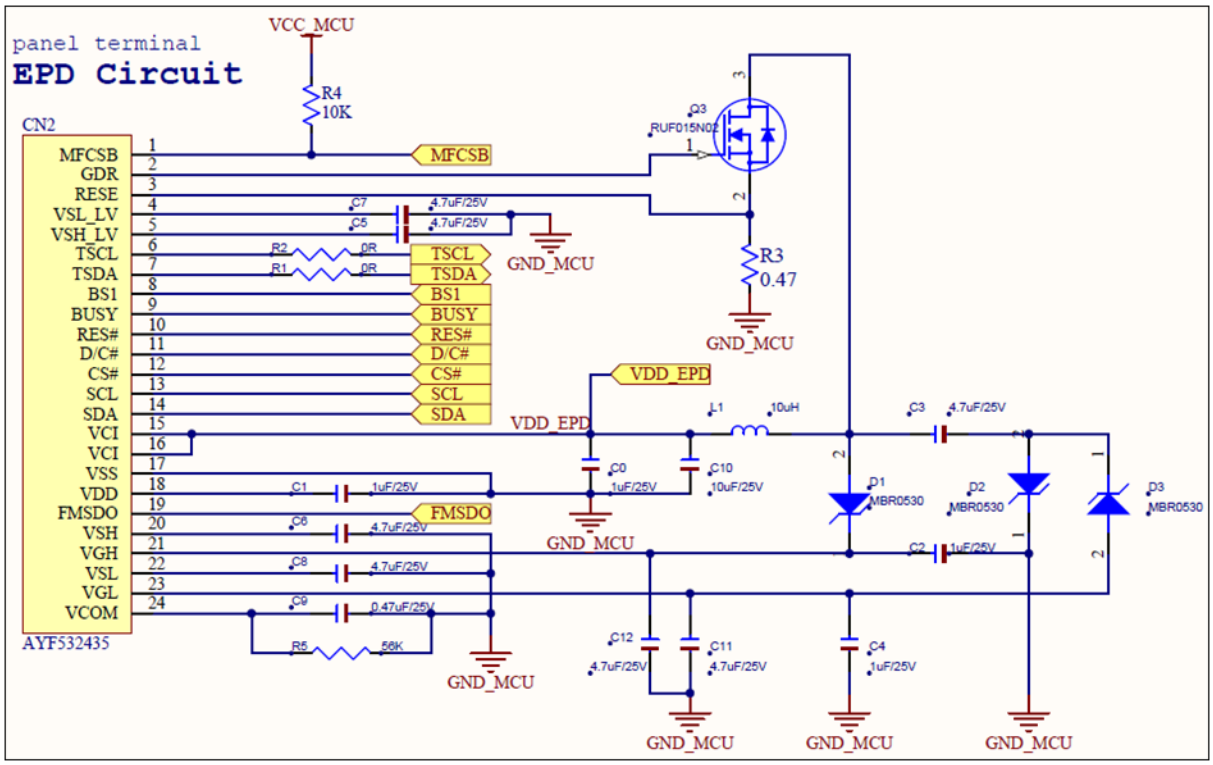
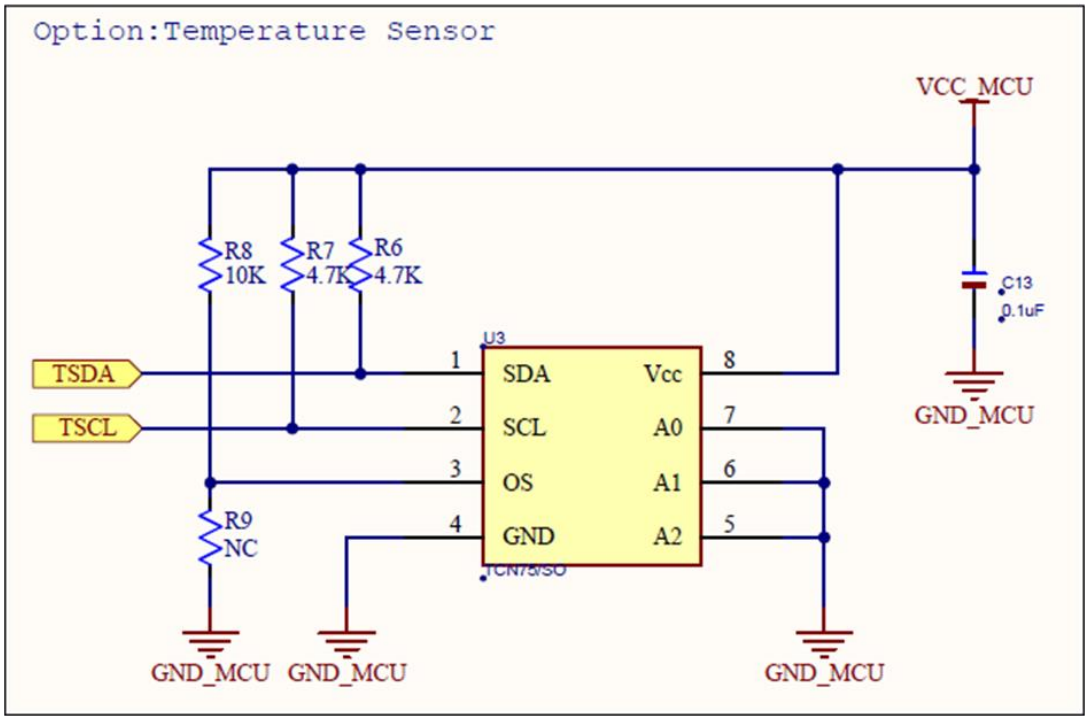


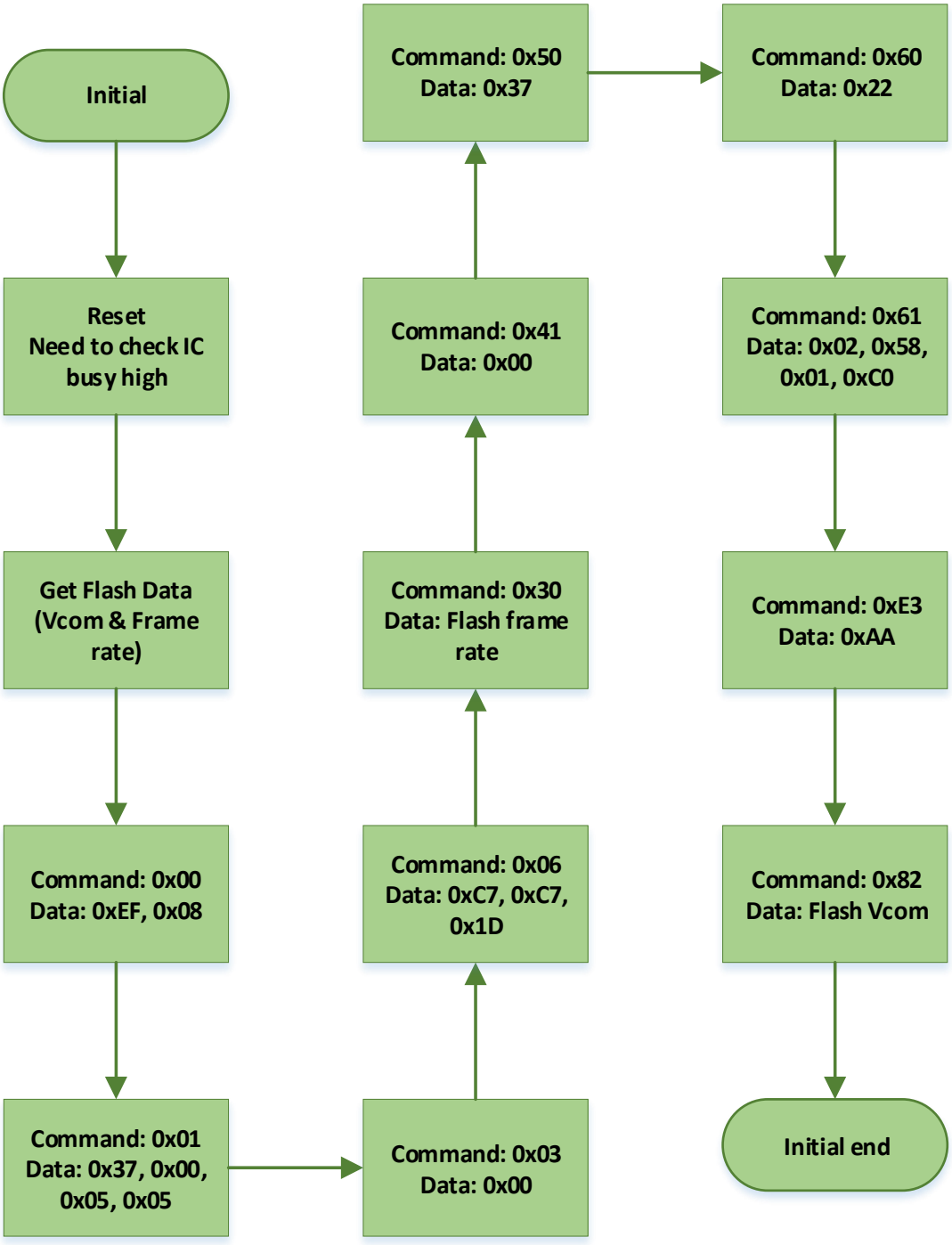
Figure 6 Temperature Sensor Circuit (optional)



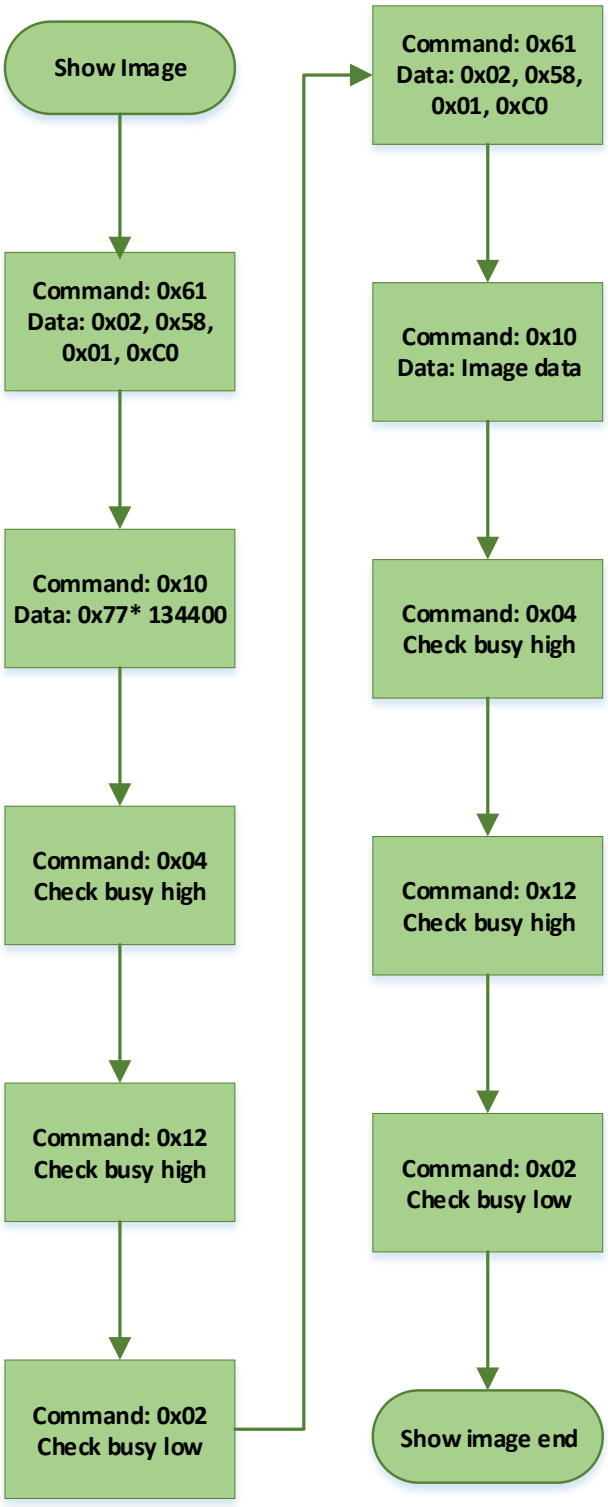
5 Software Programming Guide

This section describes the image update flow for the N-Color 5.65”. After the system MCU sends seven color image to the driver IC, the BUSY signal from the panel should be monitored and used to indicate the completion of the update.

5.1 Initial



5.2 Show Image



6 Color Mapping table for N-Color 5.65”

Color images (24 bit RGB) require conversion into the seven colors supported by 5.65" display. The color mapping is shown in the below.

Color	Color index	Raw data of image
Black	000000	000
White	FFFFFF	001
Green	00FF00	010
Blue	0000FF	011
Red	FF0000	100
Yellow	FFFF00	101
Orange	FF8000	110
Clean	-	111

Remark

The waveform to show image is designed such that every update must comprise a clean and a color. No update should be performed without clean or there would be noticeable ghosting. Show image flow in sec 5.2 comprises the clean.