DATASHEET

8/25/2010

Fema Part Number

GM240320U-28-TTX2NLW	
Description	Full Color LCD TFT
	240 x 320 Resolution
	2.8" Diagonal
	LED Backlight (250 nits typical)
	Touch Panel Optional

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1. BASIC SPECIFICATION

1.1 Mechanical specifications

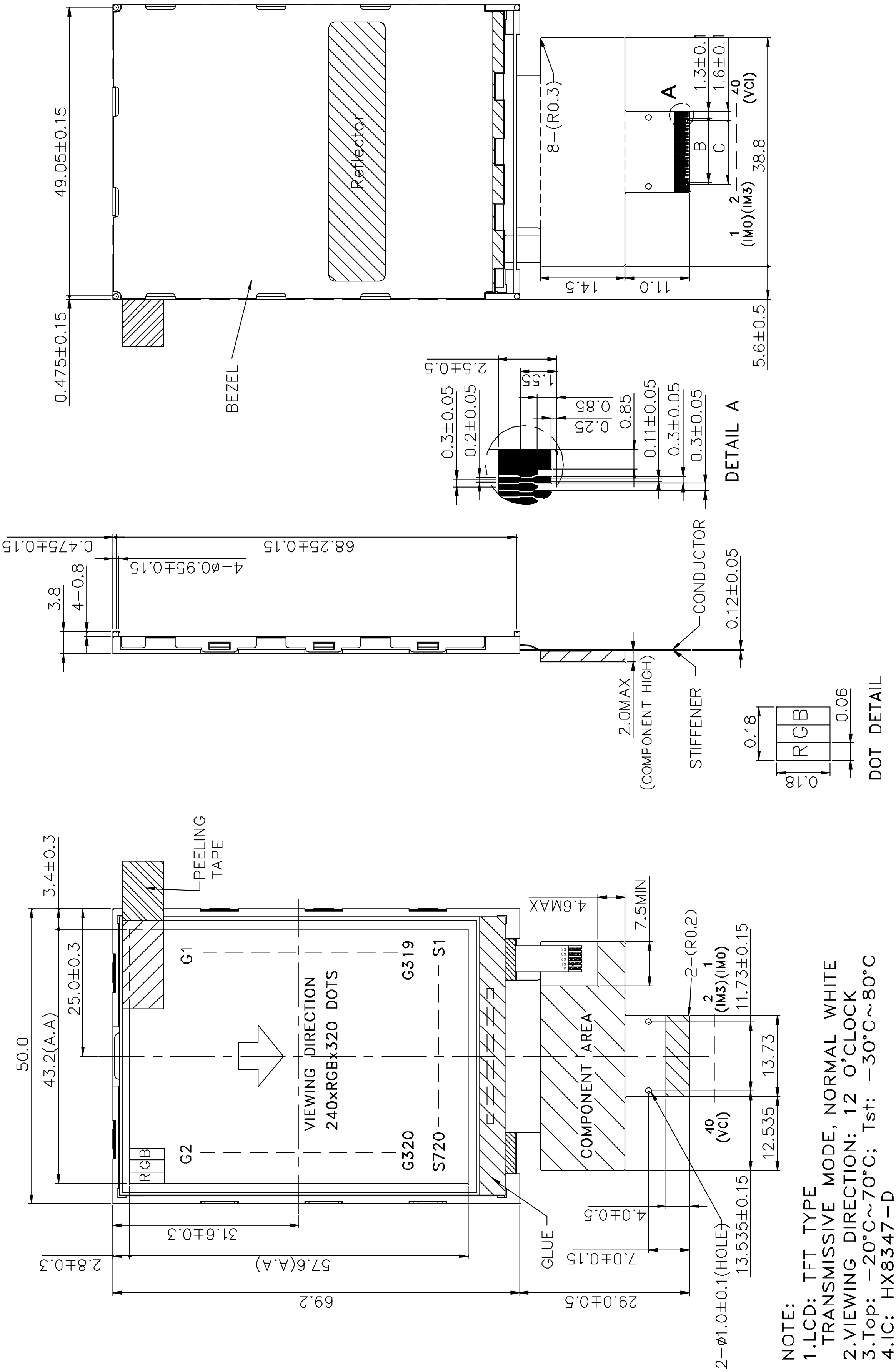
Items	Nominal Dimension	Unit
Active screen size	2.8” diagonal	-
Dot Matrix	240*RGB*320	+598
Module Size (W x H x T)	50 x 98.2 x 3.8	mm.
Active Area (W x H)	43.2 x 57.6	mm.
Pixel Size (W×H)	0.18 x 0.18	mm.
Color depth	262K	Color
Interface	8/9/16/18-bit MPU parallel	-
Driving IC Package	COG	-
Module weight	19	.

1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	
LCD Mode	TN/Normal white	
Polarizer Mode	$7(4830880;,	
Polarizer Surface	Normal	
Pixel arrangement	RGB-stripe	
Backlight Type	LED	
Viewing Direction(Gray inversion)	12 O'clock Direction	

* Color tone is slightly changed by temperature and driving voltage.

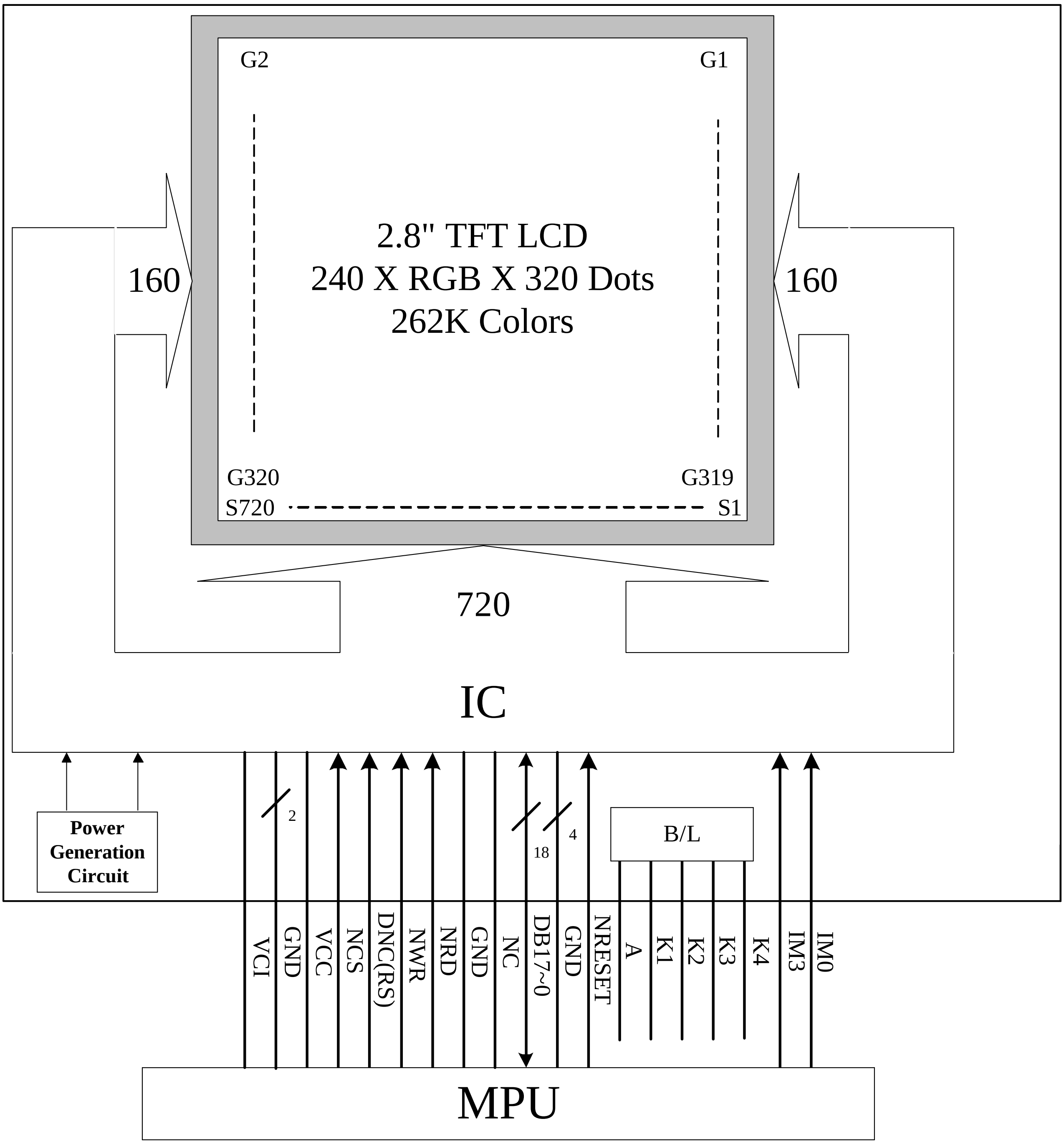
1.3 Outline dimension



NOTE:
1.LCD: TFT TYPE
TRANSMISSIVE MODE, NORMAL WHITE
2.VIEWING DIRECTION: 12 O'CLOCK
3.Top: −20°C~70°C; Tst: −30°C~80°C
4.IC: HX8347-D
5.TOLERANCE FOR NOT ASSIGNED: ±0.2mm
6.LED: WHITE 4 PCS ,Vled = 3.5V(TYP) , IF= 80.0 mA(CONSTANT CURRENT)
7.THE MINIMUM BENDING RADIUS(INNER) OF THE FPC IS 0.5mm
8.B:10.8±0.1(P0.6X18) ; C:10.8±0.1(P0.6X18)

	GM240320U-28-TTX2NLW	

1.4 Block diagram:



1.5 Interface pin :

<table>
<tr><th>Pin No.</th><th>Pin Symbol</th><th>I/O</th><th>Description</th></tr>
<tr><td>1</td><td>IM0</td><td rowspan="2">I</td><td rowspan="2">Select the MPU system interface mode
<table>
<tr><th>IM3</th><th>IM0</th><th>MPU-Interface Mode</th><th>DB Pin in use</th></tr>
<tr><td>0</td><td>0</td><td>i80-system 16-bit interface</td><td>DB[17:10], DB[8:1]</td></tr>
<tr><td>0</td><td>1</td><td>i80-system 8-bit interface</td><td>DB[17:10]</td></tr>
<tr><td>1</td><td>0</td><td>i80-system 18-bit interface</td><td>DB[17:0]</td></tr>
<tr><td>1</td><td>1</td><td>i80-system 9-bit interface</td><td>DB[17:9]</td></tr>
</table></td></tr>
<tr><td>2</td><td>IM3</td></tr>
<tr><td>3</td><td>K4</td><td>P</td><td>Cathode4 input for LED backlight.</td></tr>
<tr><td>4</td><td>K3</td><td>P</td><td>Cathode3 input for LED backlight.</td></tr>
<tr><td>5</td><td>K2</td><td>P</td><td>Cathode2 input for LED backlight.</td></tr>
<tr><td>6</td><td>K1</td><td>P</td><td>Cathode1 input for LED backlight.</td></tr>
<tr><td>7</td><td>A</td><td>P</td><td>Anode input for LED backlight.</td></tr>
<tr><td>8</td><td>NRESET</td><td>I</td><td>Reset pin. Setting either pin low initializes the LSI.
Must be reset after power is supplied</td></tr>
<tr><td>9~12</td><td>GND</td><td>P</td><td>Power Supply for Ground(0V).</td></tr>
<tr><td>13~30</td><td>DB17~DB0</td><td>I/O</td><td>18-bit bi-directional data bus.
The unused pins let to open.</td></tr>
<tr><td>31</td><td>NC</td><td>-</td><td>No connection.</td></tr>
<tr><td>32</td><td>GND</td><td>P</td><td>Power Supply for Ground(0V).</td></tr>
<tr><td>33</td><td>NRD</td><td>I</td><td>Read enable pin I80 parallel bus system interface.</td></tr>
<tr><td>34</td><td>NWR</td><td>I</td><td>Write enable pin I80 parallel bus system interface.</td></tr>
<tr><td>35</td><td>DNC(RS)</td><td>I</td><td>Command / parameter or display data selection pin.</td></tr>
<tr><td>36</td><td>NCS</td><td>I</td><td>Chip select signal.
Low: chip can be accessed;
High: chip cannot be accessed.</td></tr>
<tr><td>37</td><td>VCC</td><td>P</td><td>Digital IO Pad power supply. (+2.8V)</td></tr>
<tr><td>38~39</td><td>GND</td><td>P</td><td>Power Supply for Ground(0V).</td></tr>
<tr><td>40</td><td>VCI</td><td>P</td><td>Analog power supply. (+2.8V)</td></tr>
</table>

Recommended connector = JAE p/n FF02S40SV1

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Supply voltage for logics	VCC	-0.3	+4.6	V
Supply voltage for analog	VCI	-0.3	+4.6	V
Input voltage	Vi	-0.3	VCC+0.3	V
Operating temperature range	T_{OP}	-20	+70	℃
Storage temperature range	T_{ST}	-30	+80	℃

2.2 DC Characteristics

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage (Logic)	VCC	1.65	2.8	3.3	V	NOTE
Supply voltage (analog)	VCI	2.3	2.8	3.3	V	NOTE
Input high level voltage	V_{IH}	0.8VCC	-	VCC	V	-
Input low level voltage	V_{IL}	-0.3	-	0.2VCC	V	-
Power supply current	$I_{CC}+I_{CI}$	-	-	11	mA	NOTE

NOTE :

Measuring Condition :

Standard Value MAX.

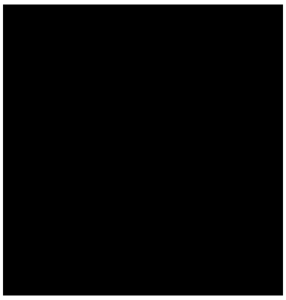
Ta = 25℃

VCC-VSS = +2.8V

VCI-VSS = +2.8V

Fosc ≒ 2.62 MHz

Display Patten



0 gray black pattern

2.2.1 Back-light Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	If	-	80	-	mA	Ta=25℃ If=80mA	-
Supply Voltage	VF	-	3.3	-	V	Ta=25℃ If=80mA	-
Half-Life Time	Lf	-	10000	-	hrs	Ta=25℃ If=80mA	1

Note 1 : The " Half-Life Time "is defined as the module brightness decrease to 50% original brightness.

2.3 Command Sequence

LCD_Initial_ HX8347-D:

Start Initial Sequence:

COMMAND	CODE	DESCRIPTION
--	LCD_RESET=1 delay 5ms LCD_RESET=0 delay 10ms	
--	00EAH 0000H	PTBA[15:8]
--	00EBH 0020H	PTBA[7:0]
--	00ECH 000CH	STBA[15:8]
--	00EDH 00C4H	STBA[7:0]
--	00E8H 0040H	OPON[7:0]
--	00E9H 0038H	OPON1[7:0]
--	00F1H 0001H	OTPS1B
--	00F2H 0010H	GEN
--	0027H 00A3H	-

Gamma 2.2 Setting:

COMMAND	CODE	DESCRIPTION
Gamma Control 1 Register	0040H 0000H	
Gamma Control 2 Register	0041H 0000H	
Gamma Control 3 Register	0042H 0001H	
Gamma Control 4 Register	0043H 0013H	
Gamma Control 5 Register	0044H 0010H	
Gamma Control 6 Register	0045H 0026H	
Gamma Control 7 Register	0046H 0008H	
Gamma Control 8 Register	0047H 0051H	
Gamma Control 9 Register	0048H 0002H	
Gamma Control 10 Register	0049H 0012H	
Gamma Control 11 Register	004AH 0018H	
Gamma Control 12 Register	004BH 0019H	
Gamma Control 13 Register	004CH 0014H	
Gamma Control 14 Register	0050H 0019H	
Gamma Control 15 Register	0051H 002FH	
Gamma Control 16 Register	0052H 002CH	

Gamma Control 17 Register	0053H 003EH	
Gamma Control 18 Register	0054H 003FH	
Gamma Control 19 Register	0055H 003EH	
Gamma Control 20 Register	0056H 002EH	
Gamma Control 21 Register	0057H 0077H	
Gamma Control 22 Register	0058H 000BH	
Gamma Control 23 Register	0059H 0006H	
Gamma Control 24 Register	005AH 0007H	
Gamma Control 25 Register	005BH 000DH	
Gamma Control 26 Register	005CH 001DH	
Gamma Control 27 Register	005DH 00CCH	

Power Voltage Setting:

COMMAND	CODE	DESCRIPTION
Power Control 2 Register	001BH 001BH	VRH=4.65V
Power Control 1 Register	001AH 0001H	BT (VGH~15V,VGL~-10V,DDVDH~5V)
Vcom Control 2 Register	0024H 002FH	VMH(VCOM High voltage ~3.2V)
Vcom Control 3 Register	0025H 0057H	VML(VCOM Low voltage -1.2V)
Vcom Control 1 Register	0023H 0086H	for Flicker adjust //can reload from OTP

Power on Setting:

COMMAND	CODE	DESCRIPTION
OSC Control 1 Register	0018H 0036H	I/P_RADJ,N/P_RADJ, Normal mode 60Hz
OSC Control 2 Register	0019H 0001H	OSC_EN='1', start Osc
Display Mode Control Register	0001H 0000H	DP_STB='0', out deep sleep
Power Control 6 Register	001FH 0088H delay 5ms	GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0080H delay 5ms	GAS=1, VOMG=00, PON=0, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0090H delay 5ms	GAS=1, VOMG=00, PON=1, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 00D0H delay 5ms	GAS=1, VOMG=10, PON=1, DK=0, XDK=0, DDVDH_TRI=0, STB=0

262k/65k color selection:

COMMAND	CODE	DESCRIPTION
COLMOD Control Register	0017H 0006H	default 0x06 262k color // 0x05 65k color

Display ON Setting:

COMMAND	CODE	DESCRIPTION
Panel Characteristic Control Register	0036H 0000H	/SS_P, GS_P,REV_P,BGR_P
Display Control 3 Register	0028H 0038H delay 40ms	GON=1, DTE=1, D=1000
Display Control 3 Register	0028H 003CH	GON=1, DTE=1, D=1100

Set Window Area:

COMMAND	CODE	DESCRIPTION
Column Address Start Register Upper Byte	0002H 0000H	
Column Address Start Register Low Byte	0003H 0000H	Column Start
Column Address End Register Upper Byte	0004H 0000H	
Column Address End Register Low Byte	0005H 00EFH	Column End
Row Address Start Register Upper Byte	0006H 0000H	
Row Address Start Register Low Byte	0007H 0000H	Row Start
Row Address End Register Upper Byte	0008H 0001H	
Row Address End Register Low Byte	0009H 003FH	Row End

Power Off Setting:

COMMAND	CODE	DESCRIPTION
Display Control 1 Register	0028H 0038H delay 40ms	GON='1' DTE='1' D[1:0]='10'
Power Control 6 Register	001FH 0089H delay 40ms	GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0, STB=1
Display Control 1 Register	0028H 0004H delay 40ms	GON='1' DTE='0' D[1:0]='01'
OSC Control 2 Register	0019H 0000H delay 5ms	OSC_EN='0'

2.4 AC Characteristics

2.4.1 Parallel Interface Characteristics (8080-series MPU)

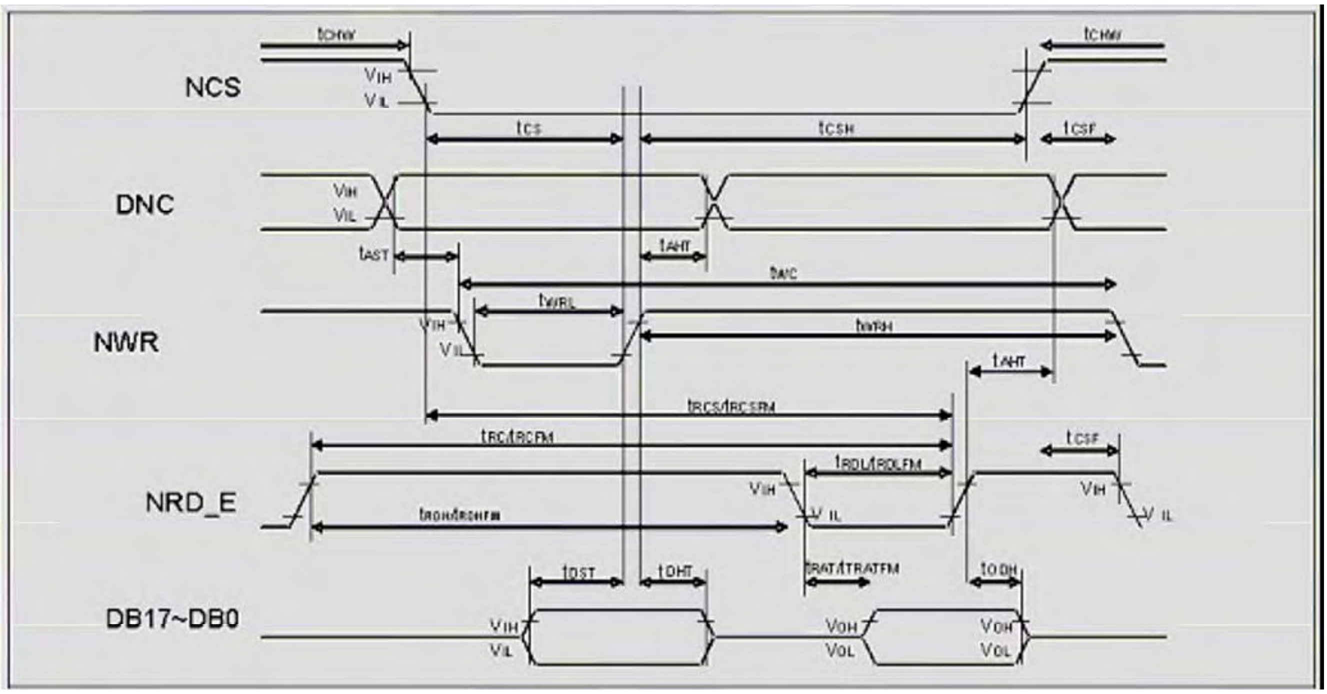
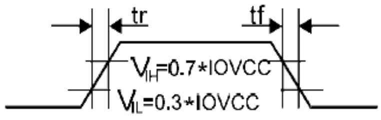


Figure 2.5.1 Parallel Interface Characteristics (8080-Series MPU)
(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V,Ta = -30 to 70 °C)

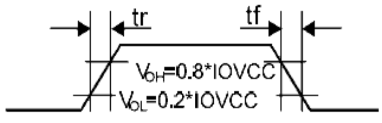
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
NCS	t_{CHW}	Chip select "H" pulse width	0	-	ns	-
	t_{CS}	Chip select setup time (Write)	15	-		
	t_{RCS}	Chip select setup time (Read ID)	45	-		
	t_{RCSFM}	Chip select setup time (Read FM)	355	-		
	t_{CSF}	Chip select wait time (Write/Read)	10	-		
	t_{CSH}	Chip select hold time	10	-		
NWR_SCL	t_{WC}	Write cycle	66	-	ns	-
	t_{WRH}	Control pulse "H" duration	15	-		
	t_{WRL}	Control pulse "L" duration	15	-		
NRD(ID)	t_{RC}	Read cycle (ID)	160	-	ns	When read ID data
	t_{RDH}	Control pulse "H" duration (ID)	90	-		
	t_{RDL}	Control pulse "L" duration (ID)	45	-		
NRD(FM)	t_{RCFM}	Read cycle (FM)	450	-	ns	When read from frame memory
	t_{RDHFM}	Control pulse "H" duration (FM)	90	-		
	t_{RDLFM}	Control pulse "L" duration (FM)	355	-		
DB17 to DB0	t_{DST}	Data setup time	10	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DHT}	Data hold time	10	-		
	t_{RAT}	Read access time (ID)	-	40		
	t_{RATFM}	Read access time (FM)	-	340		
	t_{ODH}	Output disable time	20	80		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Input Signal Slope



Output Signal Slope



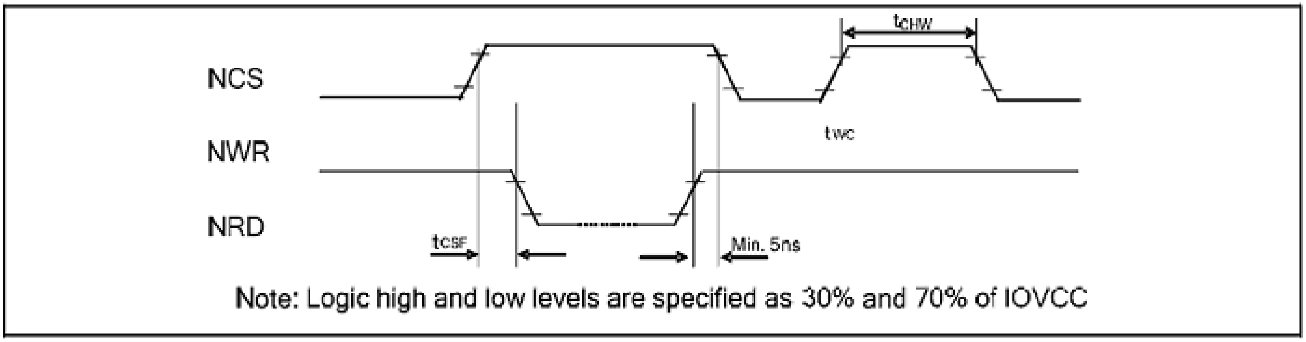


Figure 2.5.2 Chip Select Timing

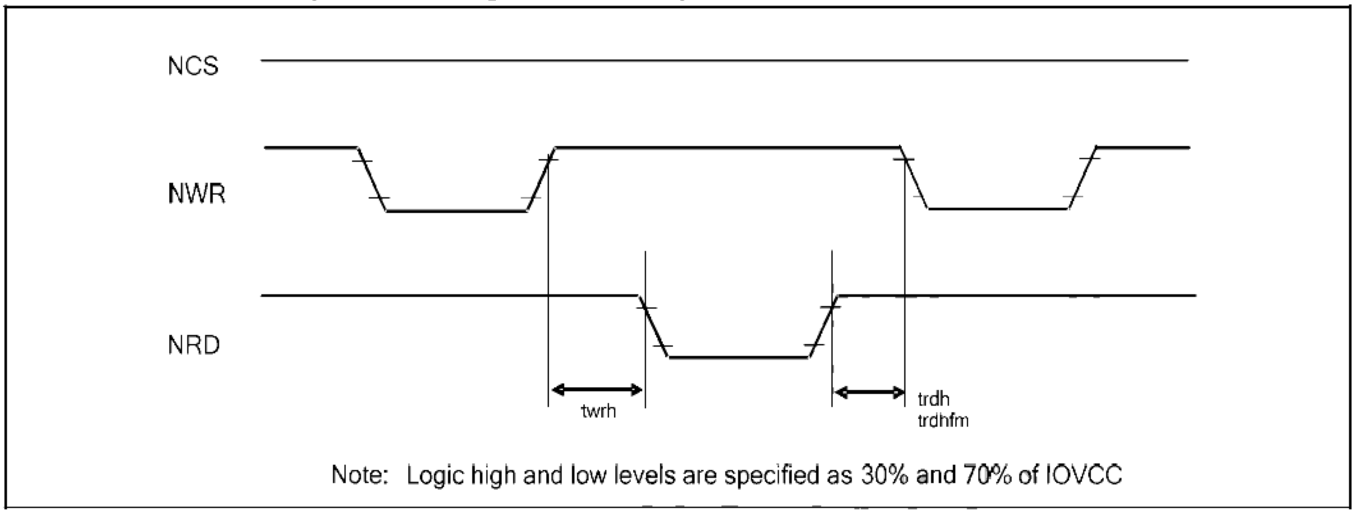


Figure 2.5.3 Write to Read and Read to Write Timing

2.4.2 Reset Timing Characteristics

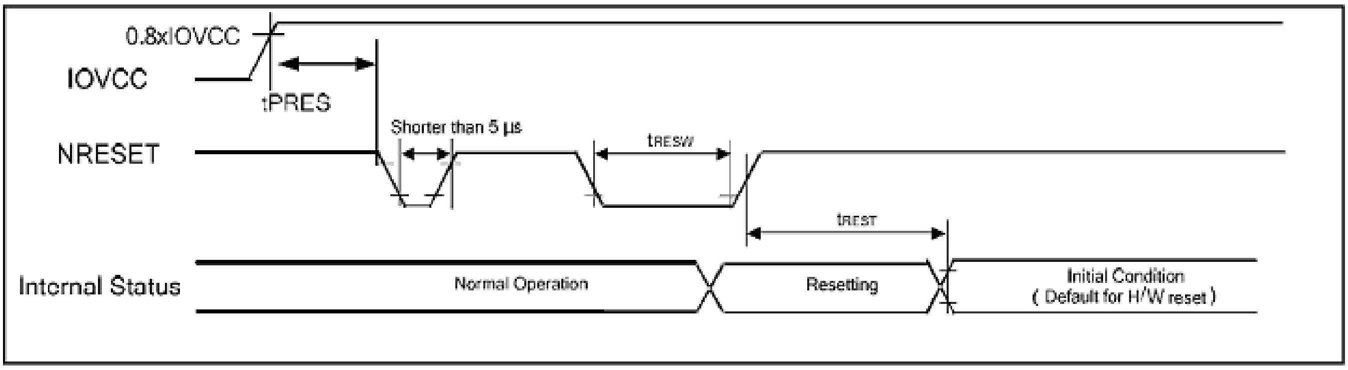


Figure 2.5.4 Reset Input Timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width(1)	NRESET	10	-	-	-	µs
tREST	Reset complete time(2)	-	-	-	5	When reset applied during STB mode	ms
		-		-	120	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	Reset goes high level after Power on	ms

Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µ	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

(2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in STB Out –mode. The display remains the blank state in STB –mode) and then return to Default condition for H/W reset.

(3) During Reset Complete Time, VMF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.

3. OPTICAL CHARACTERISTICS

3.1 Characteristics

Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr	25 ℃	NA	15	20	-2	2
				Tf	25 ℃	NA	35	50		
2	Viewing Angle	Hor.	Cr>=10	Θ_{2+}	0°	45	60	-	degree	3
				Θ_{2-}	180°	45	60	-		
		Ver.		Θ_{1+}	270°	25	35	-		
				Θ_{1-}	90°	30	45	-		
3	Contrast Ratio			Cr	25 ℃	150	250	-	-	4
4	Red x-code			Rx	25 ℃	0.58	0.63	0.68	-	5
	Red y-code			Ry		0.28	0.33	0.38		
	Green x-code			Gx		0.29	0.34	0.39		
	Green y-code			Gy		0.55	0.60	0.65		
	Blue x-code			Bx		0.09	0.14	0.19		
	Blue y-code			By		0.05	0.10	0.15		
	White x-code			Wx		0.26	0.31	0.36		
	White y-code			Wy		0.29	0.34	0.39		
	Brightness			Y		200	250	-	cd/m^2	
5	Brightness Uniformity				25 ℃	80	-	-	%	6

4. RELIABILITY :

Item No	Items	Condition
1	High temperature operating	70 ℃ , 200 hours
2	Low temperature operating	-20 ℃ , 200 hours
3	High temperature storage	80 ℃ , 200 hours
4	Low temperature storage	-30 ℃ , 200 hours
5	High temperature & humidity storage	60℃, 90%RH, 100 hours
6	Thermal Shock storage	-30℃, 30min.<=> 80℃, 30min. 10 Cycles
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction (X,Y,Z)
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges
9	Life time	50,000 hours 25℃ , 60%RH , specification condition driving

* One single product test for only one item.
* Judgment after test : keep in room temperature for more than 2 hours.
- Current consumption < 2 times of initial value
- Contrast > 1/2 initial value
- Function : work normally