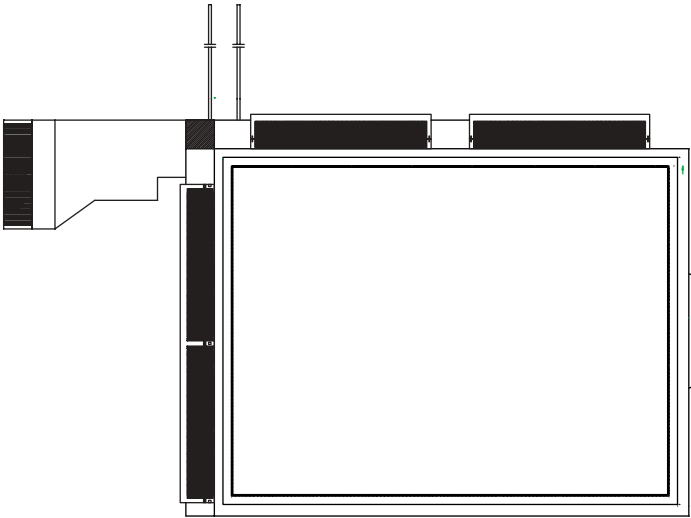




PRODUCT SPECIFICATION

HDM3224L-G

320 x240 MONOCHROME GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: ZW	REV.: 1.0	HDM3224L-G	SHEET 1 OF 12
				DATE: 8/16/06

1. General Specifications

1-1.Features

- A. Drive Method:1/240 Duty, 1/13 Bias
- B. The Module Operating Voltage: 3.0V;
- C. The LCD Operating Voltage :22.0V;
- D. Viewing Direction: 9:00
- E. Operating Temperature: -20 ° C ~70 ° C
- F. Storage Temperature: -30 ° C ~85 ° C
- G. Display type: FSTN Positive

1-2.Mechanical Data:

- (1) Module Size ----- 88.3W * 69.1 H * 6.5 L mm
- (2) Viewing Area ----- 79.8 W * 60.6 H mm
- (3) Dot Size ----- 0.225 W * 0.225 H mm
- (4) Dot Matrix----- 320 * 240
- (5) Outline Dimensions----- See Attached Drawing

1-3 . Absolute Maximum Ratings

Characteristics	Symbol	Ratings
Power Supply Voltage	VDD	-0.3V to +7.0V
Driver supply voltage	V0	-0.3V to +30V
Input Voltage	V _{IN}	-0.3V to Vdd+0.3V

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: Z.W.	REV.: 1.0	HDM3224L-G	SHEET 2 OF 12
				DATE: 8/16/06

1-4.Pin Connections:

Pin No.	Symbol	Function
1-6	VLCD ,V6, V3,V4 V5,V2	Power supply pin for LCD driver voltage
7	GND	Ground
8	VDD	Power Supply
9	FLM	First line marker
10	CL2	Display data shift clock input for segment mode
11	M	AC signal
12	CL1	Latch pulse input/shift clock input for the shift register
13	/DOFF	Control input for deselect output level
14	GND	Ground
15-18	D3-D0	Display data

1-5.DC Characteristics

Segment Mode ($V_{SS} = V_S = 0V$, $V_{DD} = 2.5 - 5.5V$, $V_O = 15$ to $30V$, and $T_A = -30$ to $+85^\circ C$, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	V_{DD}	2.5	-	5.5	V	
Operating Voltage	V_O	15	-	30	V	
Input high voltage	V_{IH}	0.8 V_{DD}	-	-	V	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and $\overline{DISPOFF}$ pins
Input low voltage	V_{IL}	-	-	0.2 V_{DD}	V	
Output high voltage	V_{OH}	$V_{DD} - 0.4$	-	-	V	EIO ₁ , EIO ₂ pins, $I_{OH} = -0.4mA$
Output low voltage	V_{OL}	-	-	+0.4	V	EIO ₁ , EIO ₂ pins, $I_{OL} = +0.4mA$
Input leakage current 1	I_{IH}	-	-	+1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and $\overline{DISPOFF}$ pins, $V_i = V_{DD}$
Input leakage current 2	I_{IL}	-	-	-1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and $\overline{DISPOFF}$ pins, $V_i = V_{SS}$
Output resistance	R_{ON}	-	1.0	1.5	k Ω	$V_O = +30.0V$ Y ₁ - Y ₂₄₀ pins, $ V_{ON} = 0.5V$
		-	1.5	2.0		$V_O = +20.0V$
Stand-by current	I_{SB}	-	-	5	μA	V_{SS} pin, Note 1
Consumed current (1) (Deselection)	I_{DD1}	-	-	2.0	mA	V_{DD} pin, Note 2
Consumed current (2) (Selection)	I_{DD2}	-	-	8.0	mA	V_{DD} pin, Note 3
Consumed current	I_O	-	-	1.0	mA	V_O pin, Note 4

Note:

1. $V_{DD} = +5.0V$, $V_O = +30V$, $V_i = V_{SS}$
2. $V_{DD} = +5.0V$, $V_O = +30V$, $f_{CLK} = 14MHz$, No-load, $EI = V_{DD}$
The input data is turned over by the data taking clock (4-bit parallel input mode)
3. $V_{DD} = +5.0V$, $V_O = +30V$, $f_{CLK} = 14MHz$, No-load, $EI = V_{SS}$
The input data is turned over by the data taking clock (4-bit parallel input mode)
4. $V_{DD} = +5.0V$, $V_O = +30V$, $f_{CLK} = 14MHz$, $f_{LP} = 41.6kHz$, $f_{FR} = 80Hz$, No-load
The input data is turned over by the data taking clock (4-bit parallel input mode)

Common Mode ($V_{SS} = V_S = 0V$, $V_{DD} = 2.5 - 5.5V$, $V_O = 15$ to $30V$, and $T_A = -30$ to $+85^\circ C$, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	V_{DD}	2.5	-	5.5	V	
Operating Voltage	V_O	15	-	30	V	
Input high voltage	V_{IH}	0.8 V_{DD}	-	-	V	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ , $\overline{DISPOFF}$ pins
Input low voltage	V_{IL}	-	-	0.2 V_{DD}	V	
Output high voltage	V_{OH}	$V_{DD} - 0.4$	-	-	V	EIO ₁ , EIO ₂ pins, $I_{OH} = -0.4mA$
Output low voltage	V_{OL}	-	-	+0.4	V	EIO ₁ , EIO ₂ pins, $I_{OL} = +0.4mA$
Input leakage current 1	I_{IH}	-	-	+10.0	μA	D0 - 6, LP, L/R, FR, MD, S/C and $\overline{DISPOFF}$ pins, $V_i = V_{DD}$
Input leakage current 2	I_{IL}	-	-	-10.0	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ , $\overline{DISPOFF}$ pins, $V_i = V_{SS}$
Input pull down current	I_{PD}	-	-	100	μA	XCK, EIO ₁ , EIO ₂ , D7 pins
Output resistance	R_{ON}	-	1.5	2.0	k	$V_O = +30.0V$ Y ₁ - Y ₂₄₀ pins, $ V_{ON} = 0.5V$
		-	2.0	2.5		$V_O = +20.0V$
Stand-by current	I_{SB}	-	-	75	μA	V_{SS} pin, Note 1
Consumed current (1)	I_{DD}	-	-	120	μA	V_{DD} pin, Note 2
Consumed current (2)	I_O	-	-	240	μA	V_O pin, Note 2

Note:

1. $V_{DD} = +5.0V$, $V_O = +30.0V$, $V_i = V_{SS}$
2. $V_{DD} = +5.0V$, $V_O = +30.0V$, $f_{LP} = 41.6KHz$, $f_{FR} = 80Hz$, case of 1/480 duty operation, No-load

1-6.AC Characteristics

Segment Mode 1 ($V_{SS} = V_S = 0V$, $V_{DD} = 4.5 - 5.5V$, $V_O = 15$ to 30 , and $T_A = -30$ to $+85^\circ C$, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WCK}	71	-		ns	$t_r, t_f \leq 10ns$, Note 1
Shift clock "H" pulse width	t_{WCKH}	23	-		ns	
Shift clock "L" pulse width	t_{WCKL}	23	-		ns	
Data setup time	t_{DS}	10	-		ns	
Data hold time	t_{DH}	20	-		ns	
Latch pulse "H" pulse width	t_{WLPH}	23	-		ns	
Shift clock rise to Latch pulse rise time	t_{LD}	0	-		ns	
Shift clock fall to Latch pulse fall time	t_{SL}	25	-		ns	
Latch pulse rise to Shift clock rise time	t_{LS}	25	-		ns	
Latch pulse fall to Shift clock rise time	t_{LH}	25	-		ns	
Input signal rise time	t_r		-	50	ns	Note 2
Input signal fall time	t_f		-	50	ns	Note 2
Enable setup time	t_S	21	-		ns	
$\overline{DISPOFF}$ Removal time	t_{SD}	100	-		ns	
$\overline{DISPOFF}$ enable pulse width	t_{WDL}	1.2	-		μs	
Output delay time (1)	t_D		-	40	ns	$C_L = 15pF$
Output delay time (2)	t_{pd1}, t_{pd2}		-	1.2	μs	$C_L = 15pF$
Output delay time (3)	t_{pd3}		-	1.2	μs	$C_L = 15pF$

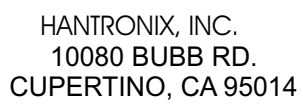
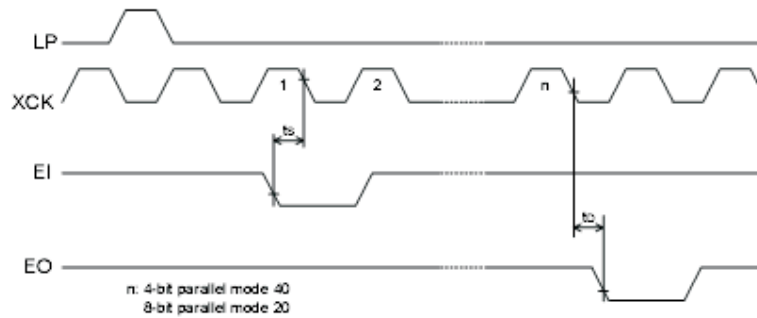
Note

1. Take the cascade connection into consideration.
2. $(T_{CK} - t_{WCKH} - t_{WCKL})/2$ is the maximum in the case of high speed operation.

Common Mode ($V_{SS} = V_S = 0V$, $V_{DD} = 2.5 - 5.5V$, $V_O = 15$ to $30V$ and $T_A = -30$ to $+85^\circ C$, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WLP}	250	-	-	ns	$t_r, t_f \leq 20ns$
Shift clock "H" pulse width	t_{WLPH}	15	-	-	ns	$V_{DD} = +5.0V \pm 10\%$
		30	-	-	ns	$V_{DD} = +2.5 - +4.5V$
Data setup time	t_{SU}	30	-	-	ns	
Data hold time	t_H	50	-	-	ns	
Input signal rise time	t_r		-	50	ns	
Input signal fall time	t_f		-	50	ns	
$\overline{DISPOFF}$ Removal time	t_{SD}	100	-	-	ns	
$\overline{DISPOFF}$ enable pulse width	t_{WDL}	1.2	-	-	μs	
Output delay time (1)	t_{DL}	-	-	200	ns	$C_L = 15pF$
Output delay time (2)	t_{pd1}, t_{pd2}	-	-	1.2	μs	$C_L = 15pF$
Output delay time (3)	t_{pd3}	-	-	1.2	μs	$C_L = 15pF$

Timing waveform of the Segment Mode



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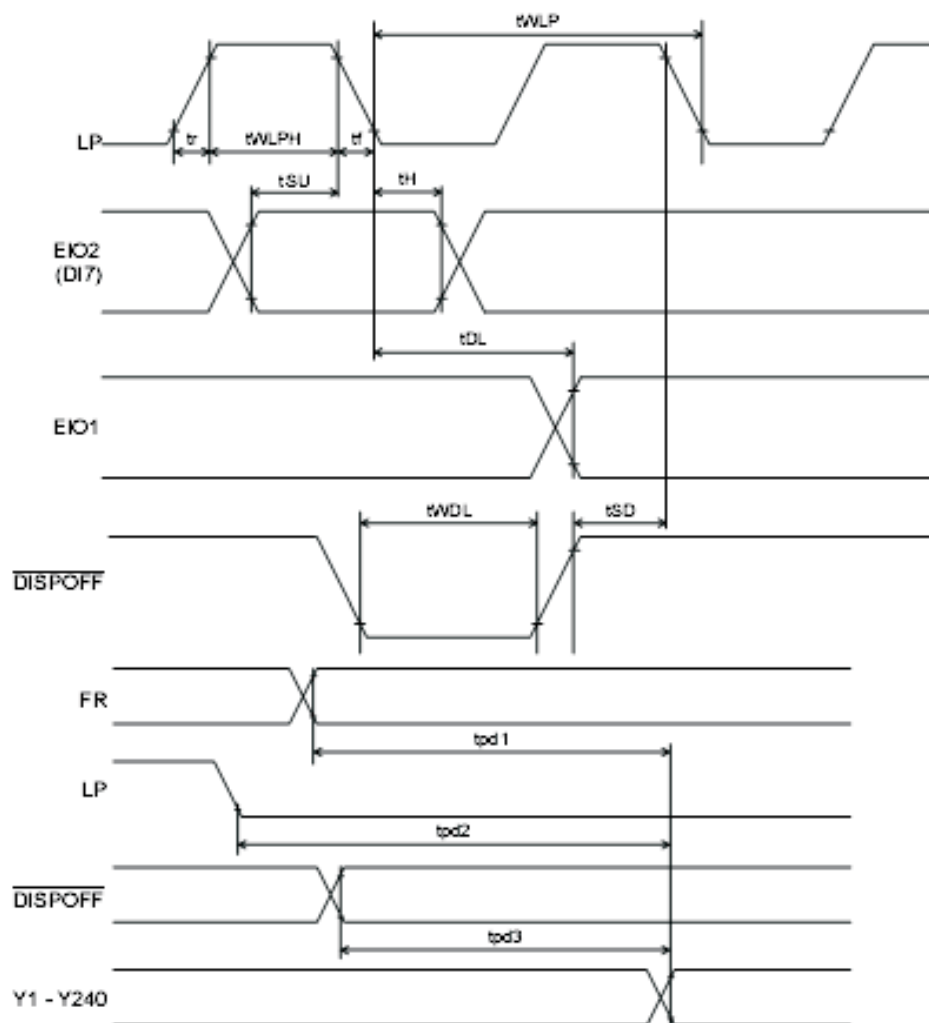
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HDM3224L-G

SHEET 6 OF 12

DATE: 8/16/06

Timing Characteristics of Common Mode



2.The Characteristics and The Reliability Test

2- 1.Electro-Optic Characteristics:

V_{dd} 3.3V

Condition:TEMP=(23 ± 3)° C

Hum=(70 ± 5)%RH

NO	Item	Symbol	Min	Typ.	Max	Unit	Condition
1	Supply Voltage(Logic)	Vdd-Vss		3.0		V	
2	LCD Operating Voltage	VLCD		22.4		V	-20 °C
				22.0		V	25 °C
				21.6		V	70 °C
3	Response Time	Ton		140		ms	
		Toff		344		ms	
4	Contrast	CR	3				
5	Viewing Angel	12H	$\theta 1$	50		Deg	(CR ≥3.0)
		6H	$\theta 2$	55			
		3H	$\theta 3$	40			
		9H	$\theta 4$	40			
6	LCD Threshold Voltage	Vth		18.8		V	25 °C

:

2. Characteristics of backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	VF	2.9	3.0	3.1	V	IF=60mA
Forward Current	IF		60		mA	
Reverse Voltage	VR		5.0		V	
Reverse Current	IR			10	uA	
Color	WHITE					

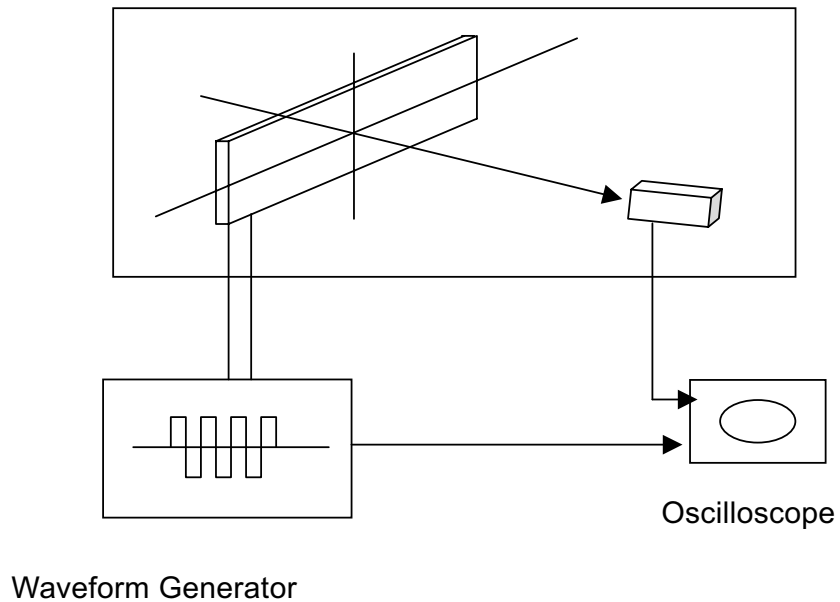
WARNING:

A BACKLIGHT IS A KIND OF CURRENT DEVICE,IT MUST CONNECT A RESISTANCE FOR LIMITING CURRENT ,OR IT WILL BE DAMAGED.

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				DATE: 8/16/06

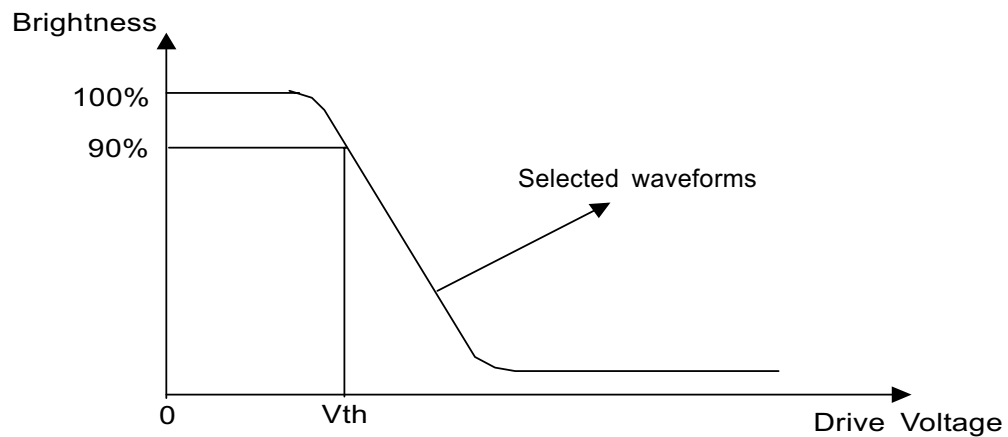
The Equipment and LCD Measuring Method

1. Equipment

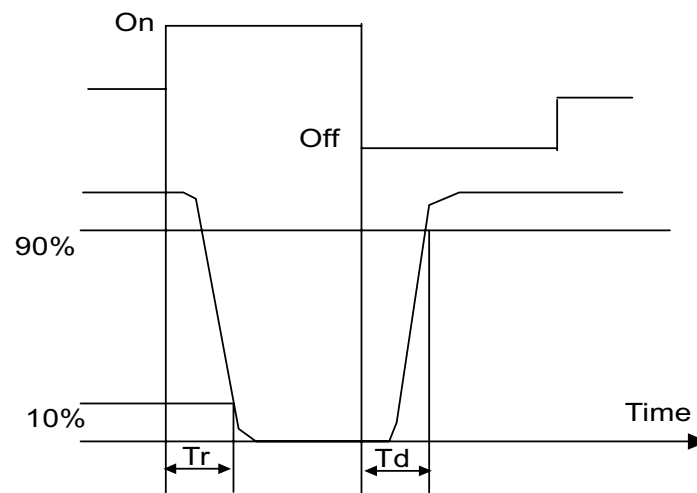


(2) Definition

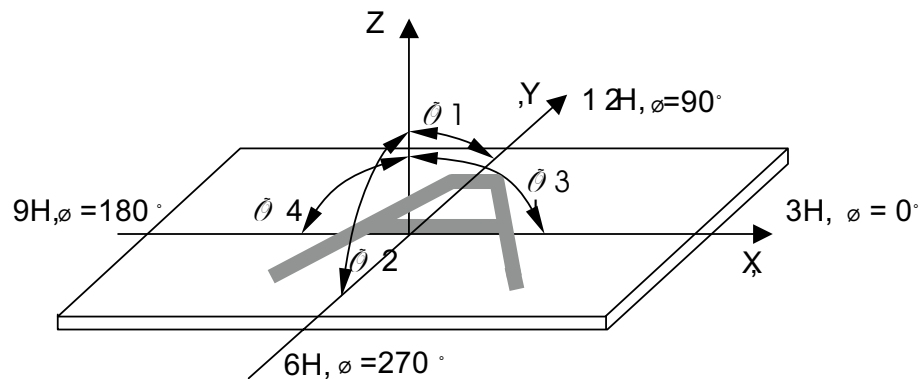
a. Threshold Voltage (V_{th})



b. Response Time



a. Viewing Angle:



b. Contrast Ratio (positive)

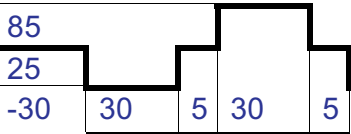
$$CR = \frac{\text{Brightness of non-selected wave-form}}{\text{Brightness of selected wave-form}}$$

4. Reliability Test:

Equipment : Tenny

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2. Reliability Test

No	Items	Test Condition	Equipment	Test Result
1	High Temp Storage	Temp: $85 \pm 2^{\circ}\text{C}$ Time: 96h Restore: 24h	Tenny	Passed
2	Low Temp Storage	Temp: $-30 \pm 3^{\circ}\text{C}$ Time: 96h Restore: 24h	Tenny	Passed
3	High Temp Static drive	Temp: $70 \pm 2^{\circ}\text{C}$ Vop: 3.3V Time: 24h Restore: 24h	Tenny	Passed
4	Low Temp Static drive	Temp: $-2 \pm 2^{\circ}\text{C}$ Vop: 3.3V Time: 24h Restore: 24h	Tenny	Passed
5	High Temp High Hum Storage	Temp: $40 \pm 2^{\circ}\text{C}$ Hum: 95%Rh Time: 96h Restore: 24h	Tenny	Passed
6	Thermal Shock	Temp: ($^{\circ}\text{C}$)  5Cycles Restore: 24h	Tenny	Passed

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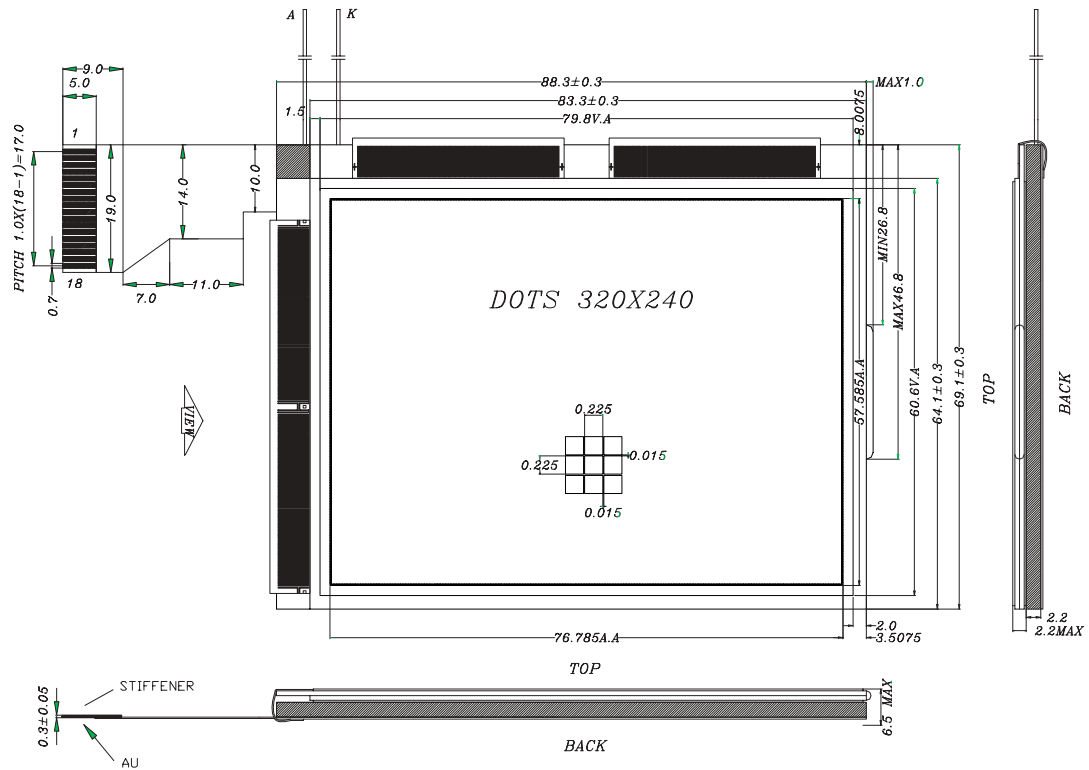
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HDM3224L-G

SHEET 11 OF 12

DATE:
8/16/06



Notes:

1. Operating Voltage: 3.0V; V_{lcd}: 22.0V
2. Drive method: 1/240Duty, 1/13Bias
3. Viewing Direction: 9:00
4. Operating Temp: -20 °C~70 °C
5. Storage Temp: -30 °C~85 °C
6. Display Type: FSTN, Positive
7. NT7701,NT7702

1	2	3	4	5	6	7	8	9
VLCB(V1)	V6	V3	V4	V5	GND(V2)	GND	VDD	FLM
10	11	12	13	14	15	16	17	18
CL2	M	CL1	DISPOFF	GND	D3	D2	D1	D0

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Q.A.:
Z.W.

REV:
1.0

HDM3224L-G

SHEET 12 OF 12

DATE:
8/16/06