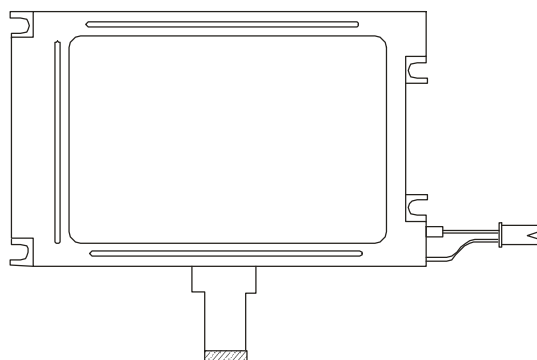




PRODUCT SPECIFICATION

HDM3224TSC-S-L

3224 COLOR GRAPHICS
LCD DISPLAY MODULE



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MECHANICAL DATA

(1) Product No.	HDM3224TSC-S-L
(2) Module Size	76.8 (W)mm x 103.75 (H)mm x 7.9(D)mm
(3) Dot Size	0.234 (W)mm x 0.068 (H)mm
(4) Dot Pitch	0.249 (W)mm x 0.083 (H)mm
(5) Number of Dots	240 (W) x (320 xRGB (H)) Dots
(6) Duty	1/240
(7) LCD Display Mode	FSTN: Color STN Module
	REAR POLARIZER: Color Transmissive Type
(8) Viewing Direction	3 O'clock
(9) Backlight	CCFL
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	65.0 g(approx.)

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ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LCD Drive	VEE-VSS	0	30.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	60
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 To $\leq 50^{\circ}\text{C}$: 85%RH max

To $> 50^{\circ}\text{C}$: Absolute humidity must be lower
than the humidity of 85%RH at 50°C

Note 3 To at -20°C will be < 48 hrs, at 60°C will be < 120 hrs

Note 4 Background will color change slightly depending on ambient temperature.
That phenomenon is reversible.

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ELECTRICAL CHARACTERISTICS

LCD

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply		VDD-VSS	Ta= 25°C		3.0	3.3	3.6	V
					4.5	5.0	5.5	
Input Voltage		VIH	H level		0.8VDD	—	VDD	V
		VIL	L level		0	—	0.2VDD	V
Recommended LCD Driving Voltage (Normal Temp. LCM)		VEE-VSS	Duty=1/240 Bias=1/14 VDD=5.0V	0°C	24.9	25.2	25.5	V
				25°C	23.7	24.0	24.3	
				50°C	22.7	23.0	23.3	
Supply Current for Logic		IDD	VDD-VSS = 5.0V VEE-VSS = 24.0V Ta= 25°C		—	2.0	3.5	mA
Supply Current for LCD		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	12.0	18.0	mA
LCM	Surface Luminance	L	VDD-VSS=5.0V VEE-VSS=24.0V Ta= 25°C IL=2.5mA _{rms}	PATTERN: (Dots All On of White Color) □ □ □ □ □ □ □ □	—	66.7	—	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	5.5	—	cd/m ²

CCFL

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V _L	—	300	—	V _{rms}	I _L = 2.5mA _{rms}
Lamp current	I _L	1.5	2.5	3	mA _{rms}	(*1)
Lamp power consumption	P _L	0.5	0.8	1	W	(*2)
Lamp frequency	F _L	30	40	50	KHz	
Lamp life time	L _L	—	20000	—	hrs	

(*1) It is recommended that I_L be not more than 2.5 mA_{rms} so that heat radiation of CCFT backlight may least affect the display quality .

(*2) Power consumption exclud inverter .

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OPTICAL CHARACTERISTICS

Optical Char. of Normal Temp. Mode

AT Vop

ITEM MODE	Cr(Contrast Ratio)						θ (Viewing Angle)		ϕ (Viewing Angle)	
	0°C		25°C		50°C		25°C		25°C	
	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	—	25	—	35	—	10	—	42	—	(L) 37 (R) 60
NOTE	NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE
R: NORMALLY BLACK 3 O'CLOCK

AT $\phi=0^\circ$ $\theta=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	550	700	850	ms	NOTE 2
		25°C	210	260	310		
		50°C	80	100	120		
Response Time (fall)	Tf	0°C	220	270	320	ms	NOTE 2
		25°C	65	80	95		
		50°C	45	60	75		

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Color of CIE Coordinate

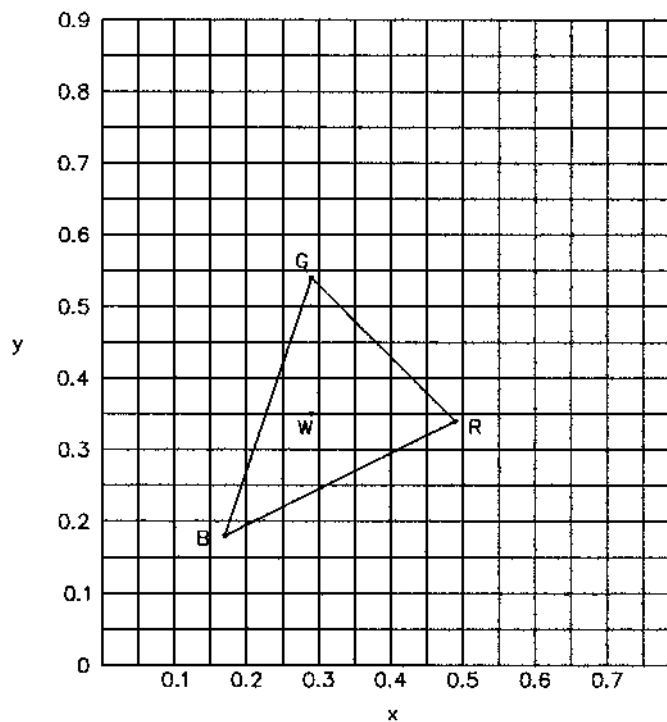
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^{\circ}$, $\theta=0^{\circ}$	0.49	17.2	Note※
		y		0.34		
	Green	X		0.29	46.1	
		y		0.53		
	Blue	X		0.17	16.1	
		y		0.18		
	White	X		0.29	66.7	
		y		0.35		

Note* Measuring at position 3 on Fig.1
CIE chromaticity diagram

Tolerance : ± 0.05

Fig.1



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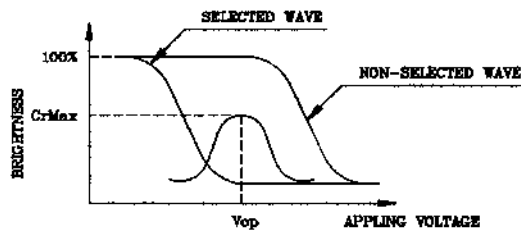
HDM3224TSC-S-L

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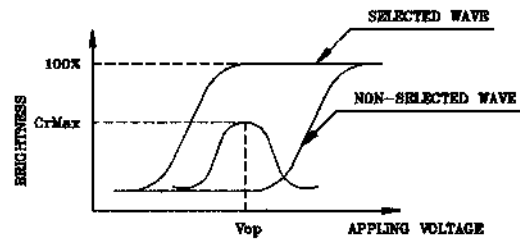
DATE:
2/22/01

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

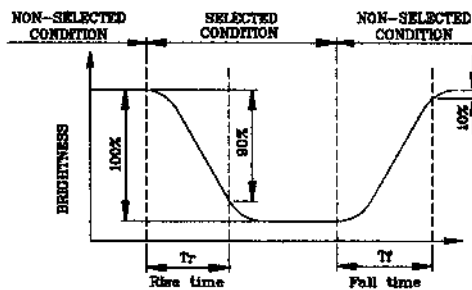
Viewing Angle : 0

Frame Frequency : 70Hz

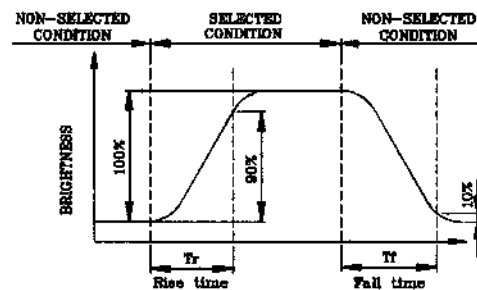
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r, T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

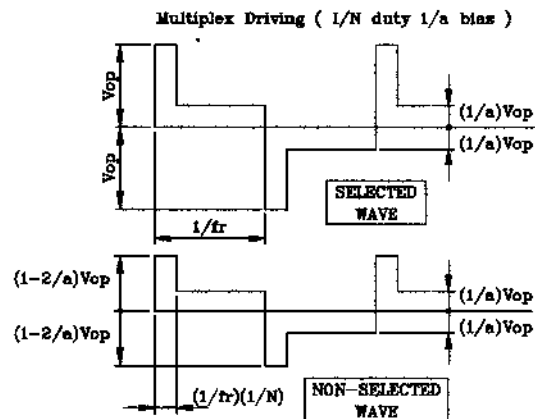
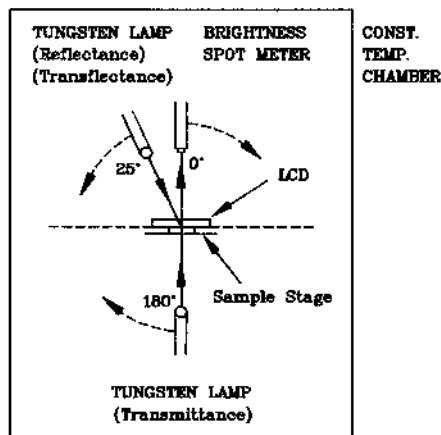
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

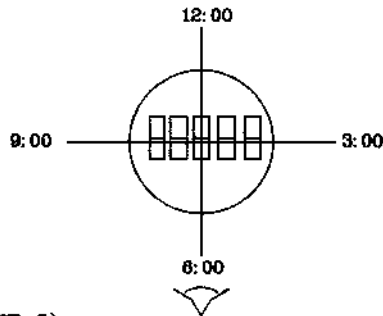
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



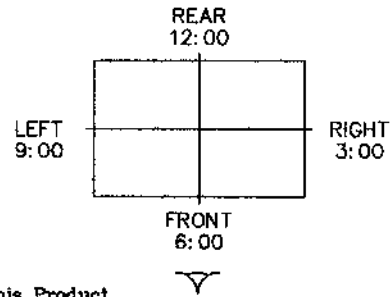
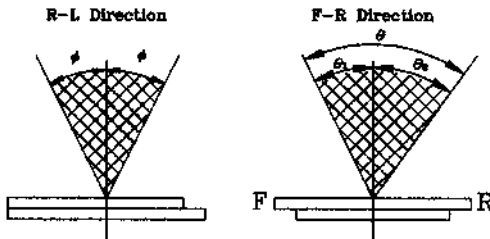
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product
The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

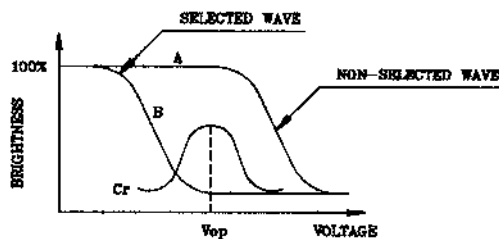
$$\theta = \theta_1 + \theta_2$$

*Conditions

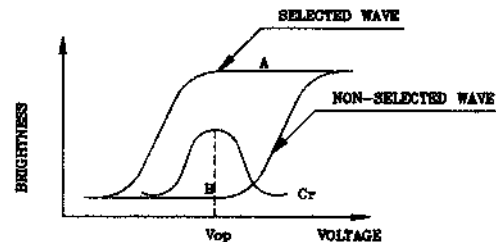
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

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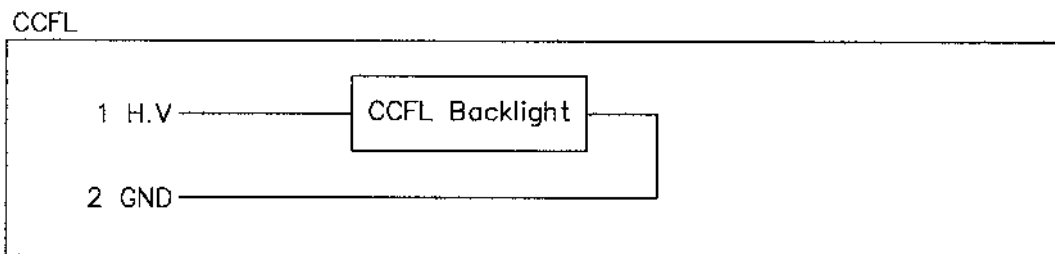
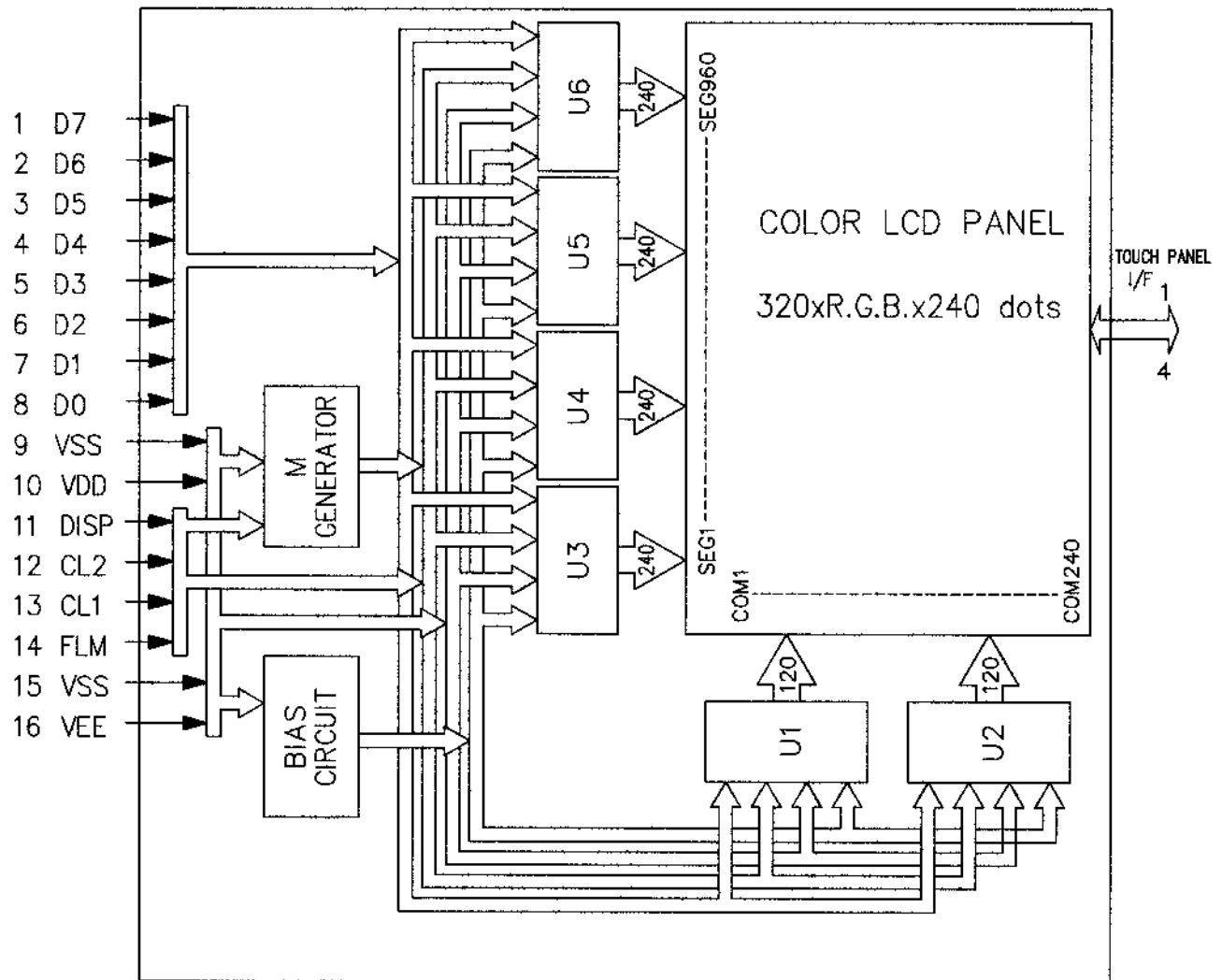
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5.BLOCK DIAGRAM



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INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	D7	H/L	Display Data
2	D6	H/L	Display Data
3	D5	H/L	Display Data
4	D4	H/L	Display Data
5	D3	H/L	Display Data
6	D2	H/L	Display Data
7	D1	H/L	Display Data
8	D0	H/L	Display Data
9	VSS	—	GND
10	VDD	—	Power Supply for Logic
11	DISP	H/L	Display Control Signal, H : Display on L : Display off
12	CL2	H/L	Data input clock
13	CL1	H/L	Input data latch signal
14	FLM	H/L	Scan start-up signal
15	VSS	H/L	Power Supply (0V,GND)
16	VEE	—	Power Supply for LCD

CCFL

Pin No.	Symbol	Level	Function
1	H.V	—	Power Supply for CFL
2	GND	—	CFL GND

LCD INTERFACE CONNECTOR

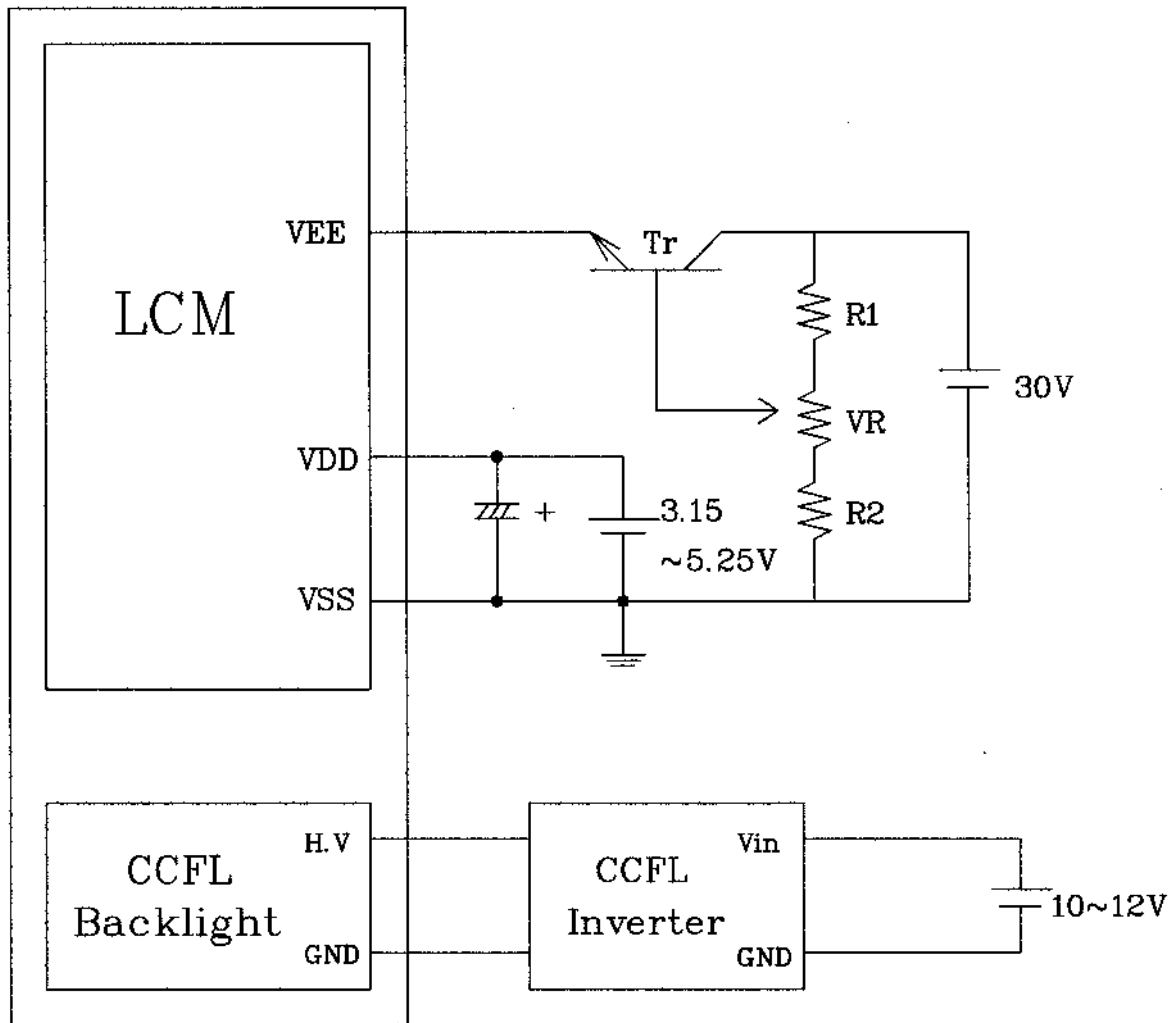
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

CCFL CONNECTOR :

BHSR -02VS-1 (JST)/Suitable Connector :SM02B-BHSS-1-TB (JST)

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POWER SUPPLY



1. $R1 + R2 + VR = 10 \sim 20K \Omega$
2. RECOMMENDED CCFL INVERTER :
COTEK INV-B1

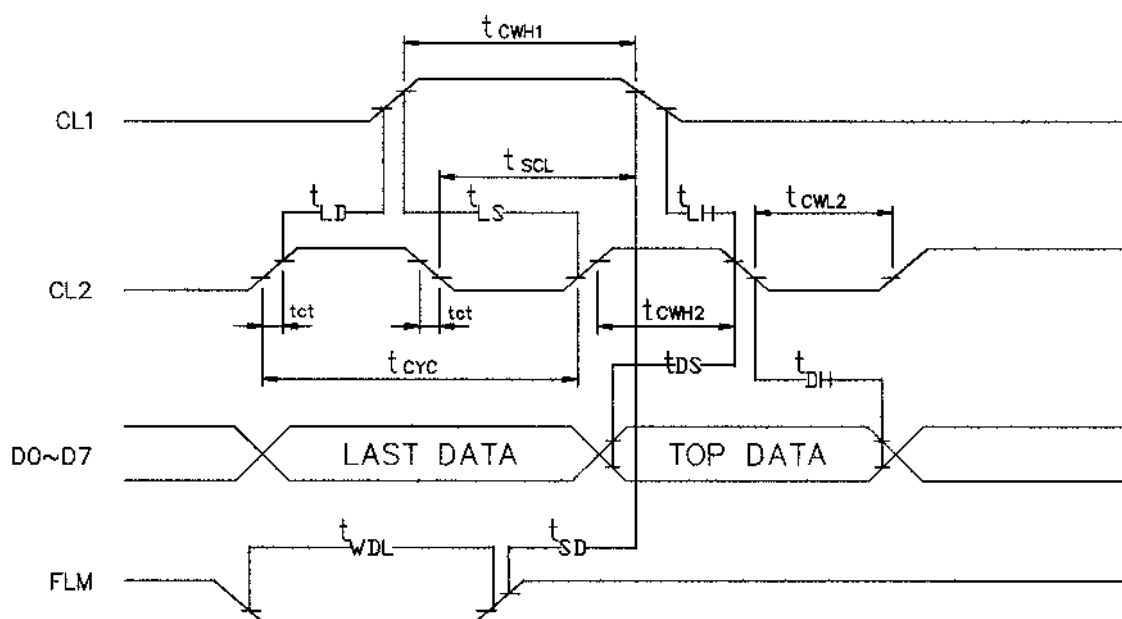
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TIMING CHARACTERISTICS

INTERFACE TIMING

VDD=5.0V $\pm$ 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK CYCLE TIME	t_{CYC}	50	—	ns
CL2 HIGH LEVEL WIDTH	t_{CWH2}	15	—	ns
CL2 LOW LEVEL WIDTH	t_{CWL2}	15	—	ns
CL1 HIGH LEVEL WIDTH	t_{CWH1}	25	—	ns
CL2 SETUP TIME	t_{SCL}	100	—	ns
CL2 HOLD TIME	t_{HCL}	100	—	ns
CL2 - CL1 RISE TIME	t_{LD}	5	—	ns
CLOCK RISE / FALL TIME	t_{CT}	—	—	ns
DATA SETUP TIME	t_{DS}	10	50	ns
DATA HOLD TIME	t_{DH}	15	—	ns
FLM SETUP TIME	t_{FS}	30	—	ns
DATA HOLD TIME	t_{FH}	50	—	μ s
FRAME FREQUENCY	t_{FLM}	60	—	ns



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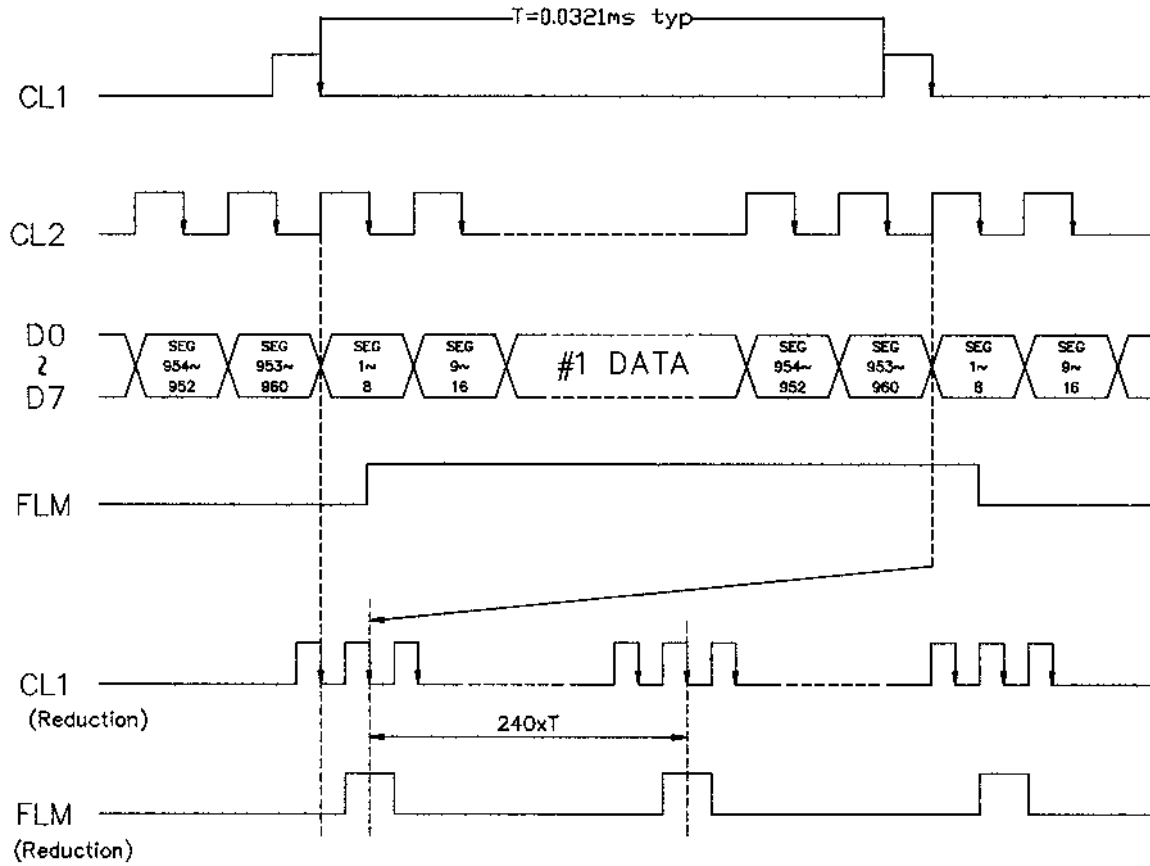
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TIMING CHART OF INPUT SIGNAL



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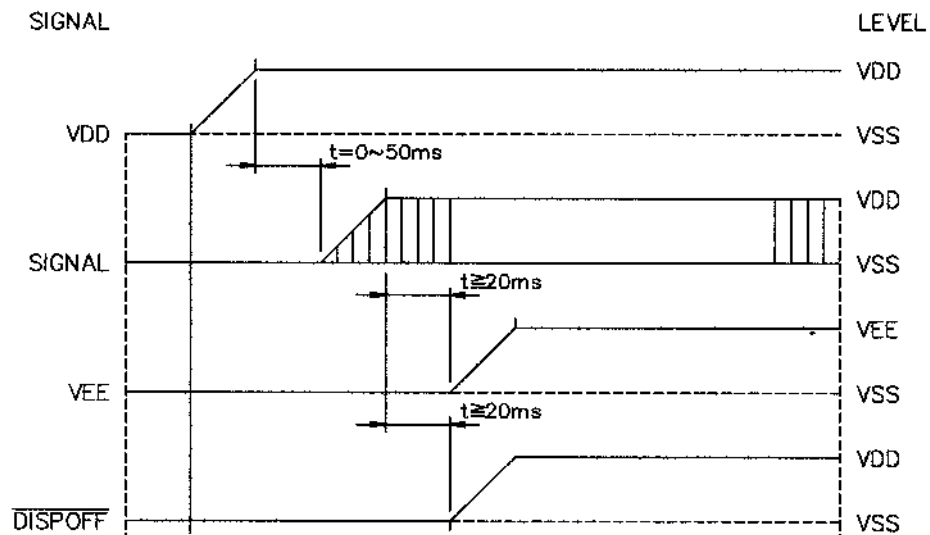
HDM3224TSC-S-L

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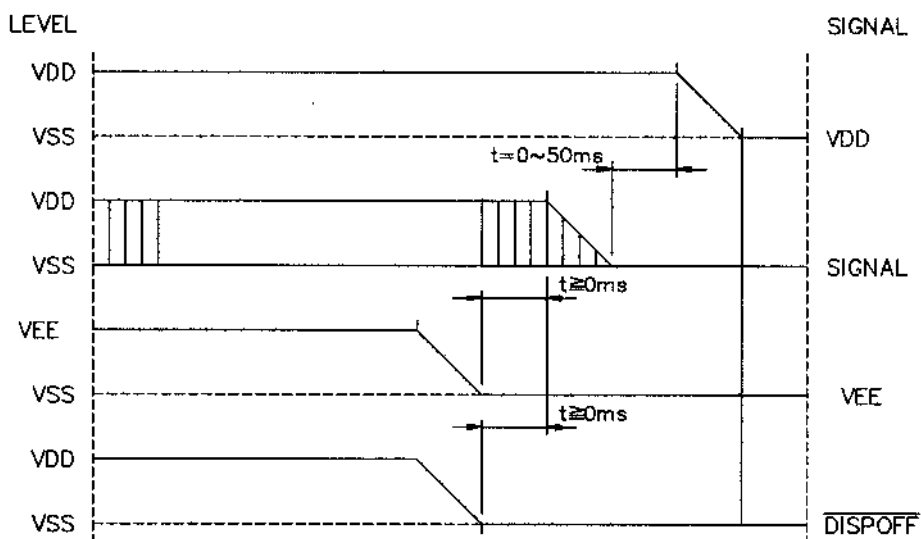
DATE:
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POWER ON/OFF TIMING

ON SEQUENCE



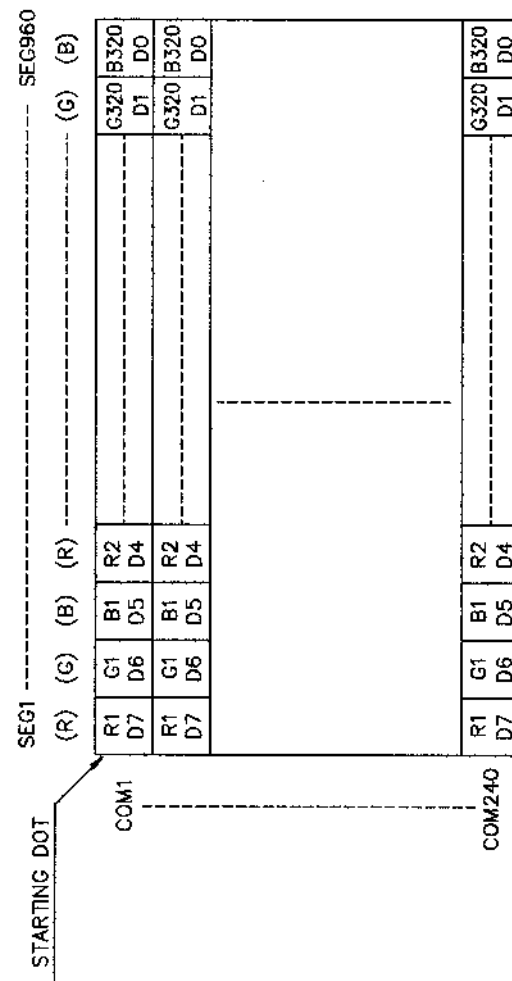
OFF SEQUENCE



Please maintain the above sequence when turning on and off the power supply of the module. If $\overline{\text{DISPOFF}}$ is supplied to the module while internal alternate signal for LCD driving(M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

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DISPLAY PATTERN



D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

NOTICE:

• **SAFETY**

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

• **HANDLING**

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

• **STORAGE**

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

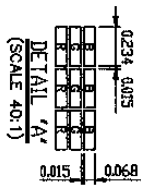
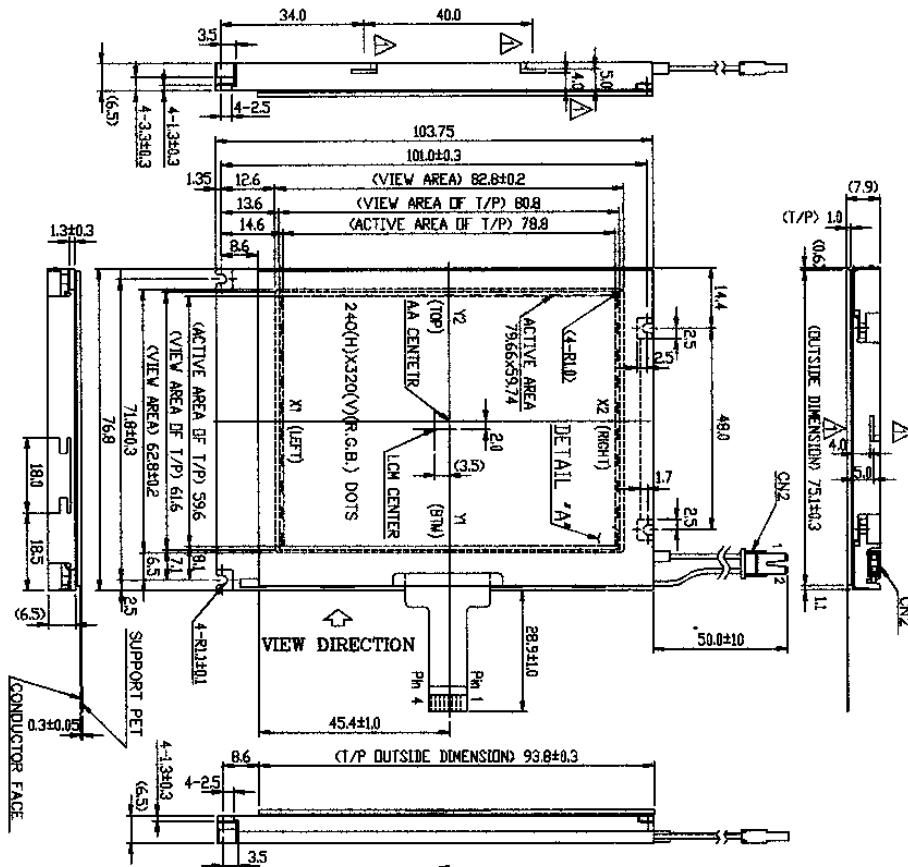
• **TERMS OF WARRANT**

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

• **THE OPERATING LIFE TIME OF BACK LIGHT**

CCFT : 20,000hrs for lamp--current 2.5mA, 40KHz, 25°C
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

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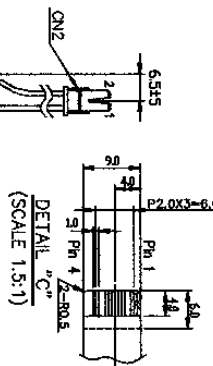
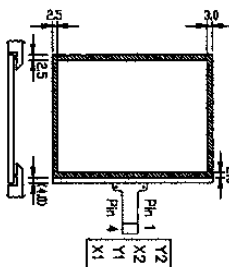
NOTE:
 1. RESOLUTION: 240(H)x320(V)(R.G.B.) DOTS
 2. BACKLIGHT: CCFL
 3. FRAME MATERIAL: SUS304 (0.3mmt)
 3. TOUCH PANEL: CLEAR TYPE (1.0mmt)
 LIGHT TRANSPARENCY: 80%

START X240
 DISPLAY PATTERN

Y320		X320	
R320	G320	B320	D0
R1	G1	B1	D1
R2	G2	B2	D2
R3	G3	B3	D3
R4	G4	B4	D4
R5	G5	B5	D5
R6	G6	B6	D6
R7	G7	B7	D7
R8	G8	B8	D8
R9	G9	B9	D9
R10	G10	B10	D10
R11	G11	B11	D11
R12	G12	B12	D12
R13	G13	B13	D13
R14	G14	B14	D14
R15	G15	B15	D15
R16	G16	B16	D16
R17	G17	B17	D17
R18	G18	B18	D18
R19	G19	B19	D19
R20	G20	B20	D20
R21	G21	B21	D21
R22	G22	B22	D22
R23	G23	B23	D23
R24	G24	B24	D24
R25	G25	B25	D25
R26	G26	B26	D26
R27	G27	B27	D27
R28	G28	B28	D28
R29	G29	B29	D29
R30	G30	B30	D30
R31	G31	B31	D31
R32	G32	B32	D32
R33	G33	B33	D33
R34	G34	B34	D34
R35	G35	B35	D35
R36	G36	B36	D36
R37	G37	B37	D37
R38	G38	B38	D38
R39	G39	B39	D39
R40	G40	B40	D40
R41	G41	B41	D41
R42	G42	B42	D42
R43	G43	B43	D43
R44	G44	B44	D44
R45	G45	B45	D45
R46	G46	B46	D46
R47	G47	B47	D47
R48	G48	B48	D48
R49	G49	B49	D49
R50	G50	B50	D50
R51	G51	B51	D51
R52	G52	B52	D52
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R59	G59	B59	D59
R60	G60	B60	D60
R61	G61	B61	D61
R62	G62	B62	D62
R63	G63	B63	D63
R64	G64	B64	D64
R65	G65	B65	D65
R66	G66	B66	D66
R67	G67	B67	D67
R68	G68	B68	D68
R69	G69	B69	D69
R70	G70	B70	D70
R71	G71	B71	D71
R72	G72	B72	D72
R73	G73	B73	D73
R74	G74	B74	D74
R75	G75	B75	D75
R76	G76	B76	D76
R77	G77	B77	D77
R78	G78	B78	D78
R79	G79	B79	D79
R80	G80	B80	D80
R81	G81	B81	D81
R82	G82	B82	D82
R83	G83	B83	D83
R84	G84	B84	D84
R85	G85	B85	D85
R86	G86	B86	D86
R87	G87	B87	D87
R88	G88	B88	D88
R89	G89	B89	D89
R90	G90	B90	D90
R91	G91	B91	D91
R92	G92	B92	D92
R93	G93	B93	D93
R94	G94	B94	D94
R95	G95	B95	D95
R96	G96	B96	D96
R97	G97	B97	D97
R98	G98	B98	D98
R99	G99	B99	D99
R100	G100	B100	D100

(T/P) CONNECTOR INTERFACE	
PIN NO	SYMBOL
1	Y2
2	X2
3	Y1
4	X1
	LEFT DIRECTION

ATTACHMENT SPACE



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