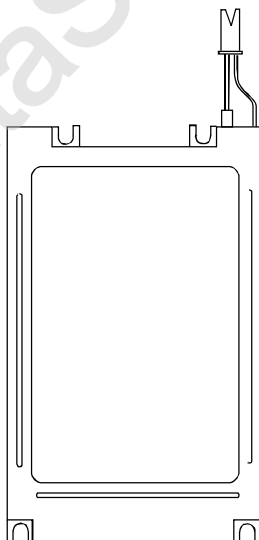


HANTRONIX

PRODUCT SPECIFICATION

HDM3224CL-S-TF

320x240 COLOR GRAPHICS
TRANSFLECTIVE
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 1 OF 19
				DATE: 10/20/03

1.MECHANICAL DATA

(1) Product No.	HDM3224CL-S-TF		
(2) Module Size	76.8 (W)mm x 103.7 (H)mm x 5.7 (D)mm		
(3) Dot Size	0.239 (W)mm x 0.073 (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 Transflective type	
(8) Viewing Direction	6 O'clock		
(9) Backlight	LED		
(10) Controller	Excluded		
(11) DC/DC Converter	Excluded		
(12) Weight	66.5g (approx.)		

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 2 OF 19
				DATE: 10/20/03

2.ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD	-0.3	7.0	V	Note 1
Power Supply For LC	VH	-0.3	+25	V	Note 1
	VM	-0.3	5.0	V	Note 1
Static Electricity	-	-	-	-	Note 2

Note 1. All voltage values are referred to GND=0V

Note 2. Make certain you are GROUNDED when handling LCM

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-40	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 To $\leq 70^{\circ}\text{C}$: 75%RH max

Note 3 To at -40°C will be < 120hrs, at 80°C will be < 120hrs

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 3 OF 19
				DATE: 10/20/03

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS of LCM

(VDD=3.3V±5%)

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage		V _{IH}	H level		0.8V _{CC}	—	V _{CC}	V
		V _{IO}	L level		0	—	0.2V _{CC}	V
Recommended LC Driving Voltage		V _{EE} - V _{SS}	Duty= 1/240 VDD=3.3V VSS=0V	-20°C	21.8	22.1	22.4	V
				0°C	20.9	21.2	21.5	
				25°C	19.7	20.0	20.3	
				50°C	18.5	18.8	19.1	
				70°C	17.3	17.6	17.9	
Power Supply Current		I _{DD}	VDD - VSS = 3.3V VEE - VSS = 20.0V		—	9.0	13.5	mA
		I _{EE}	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	0.3	0.5	mA
LCM	Surface Luminance	L	① Transmission Mode ② LED BACKLIGHT CONDITION : { V _F = 3.6V I _F = 140 mA ③ VDD - VSS = 3.3V ④ VEE - VSS = 20.0V	PATTERN: (Dots All On) □ □ □ □ □ □ □ □	—	31.6	—	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	3.8	—	cd/m ²

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I _P	—	—	175	mA	—
Maximum reverse voltage	V _R	—	—	5	V	—
Applied forward current	I _F	—	140	—	mA	at V _F = 3.6 V
Applied forward voltage	V _F	3.3	3.6	4.0	V	at I _F = 140 mA
LED power consumption	P ₀	—	0.7	—	W	at V _{AK} = 5.0 V
LED life time	L _L	—	10000	—	hrs	at I _F = 140 mA (*1)
AVG. X of 1931 C.I.E.	X	0.31	0.33	0.35	—	—
AVG. Y of 1931 C.I.E.	Y	0.31	0.33	0.35	—	—

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 5 OF 19
				DATE: 10/20/03

4.OPTICAL CHARACTERISTICS

AT Vap

ITEM MODE			Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
			-20℃		0℃		25℃		50℃		75℃		25℃		25℃	
			MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
Z	V	Reflective	1.5	3.0	2.0	3.5	3.0	4.5	2.0	3.5	1.0	2.0	-	61	-	±20
		Transmission	4.0	5.5	6.5	8.0	12.0	13.5	6.0	7.5	2.0	3.5	-	75	-	±55
Note			NOTE 6										NOTE 5			

NOTE :

Z: TRANSFLECTIVE(PCF)

V: SPECIAL POLARIZER, 6 O'CLOCK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	3175	3970	5955	ms	NOTE 2
		0℃	680	850	1275		
		25℃	230	290	435		
		50℃	110	135	200		
		70℃	70	90	135		
Response Time (fall)	Tf	-20℃	2055	2570	3855	ms	NOTE 2
		0℃	410	510	765		
		25℃	110	140	210		
		50℃	50	65	100		
		70℃	50	60	90		

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

JK

REV.:

1.2

HDM3224CL-S-TF

SHEET 6 OF 19

DATE:

10/20/03

4-2 Color of CIE Coordinate

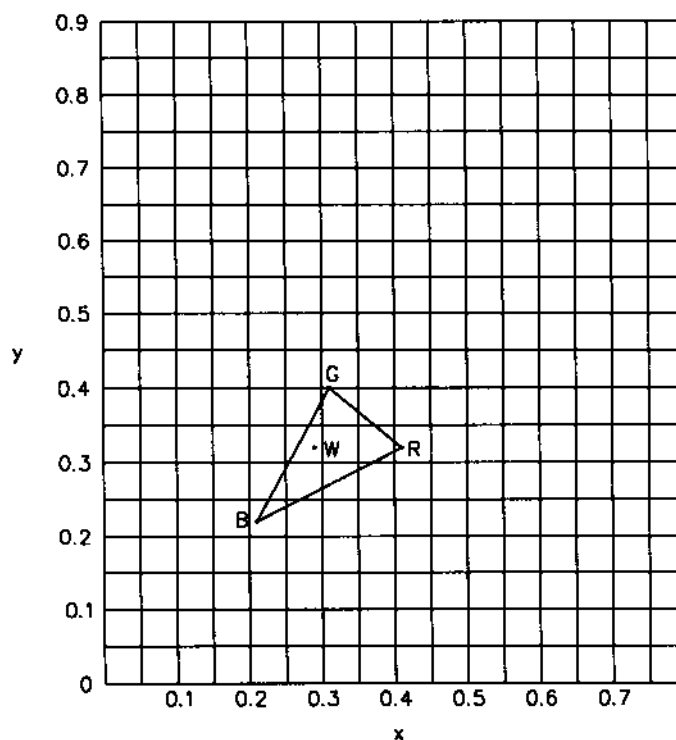
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ$, $\theta=0^\circ$	0.41	9.9	Note※
		y		0.32		
	Green	X		0.31	18.4	
		y		0.40		
	Blue	X		0.21	10.6	
		y		0.22		
	White	X		0.29	31.6	
		y		0.32		

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

Tolerance : ± 0.05

Fig.1



HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JK

REV.:
1.2

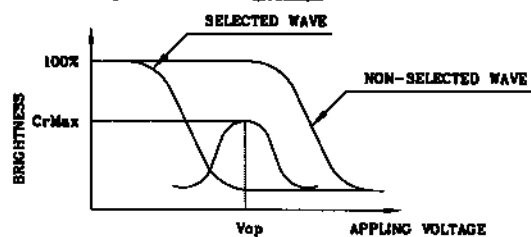
HDM3224CL-S-TF

SHEET 7 OF 19

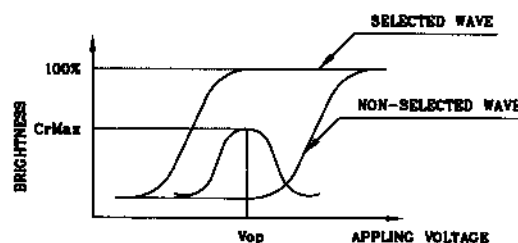
DATE: 10/20/03

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

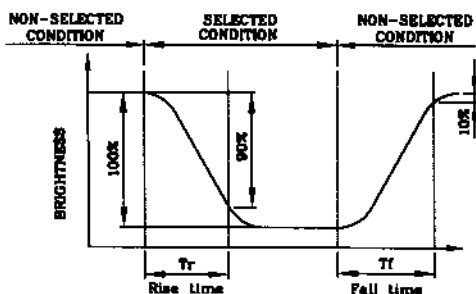
Viewing Angle : 0

Frame Frequency : 70Hz

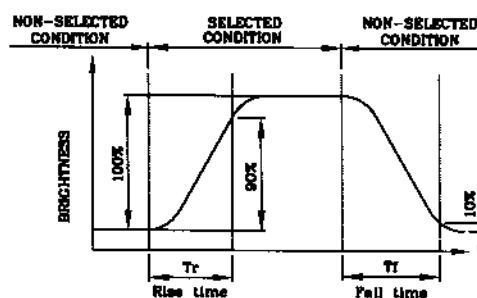
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

Operating Voltage : Vop

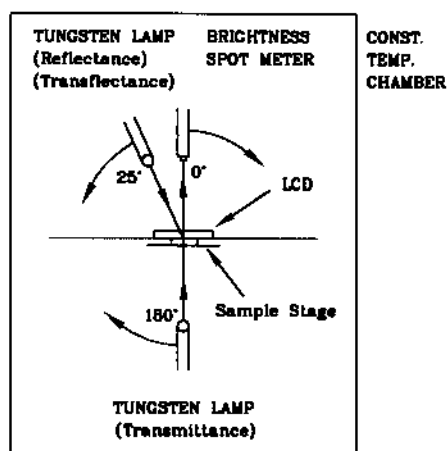
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

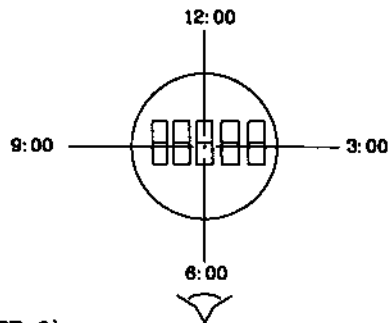


The voltage relationship of each signal is as follow
Multiplex Driving (1/N duty 1/a bias)

Segment voltage	Segment waveform	Common waveform	Common voltage
V0 VM V1			VH VM VL
	Normally display period	Off-display period	

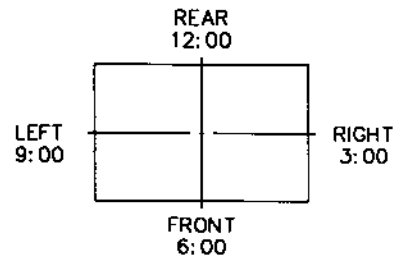
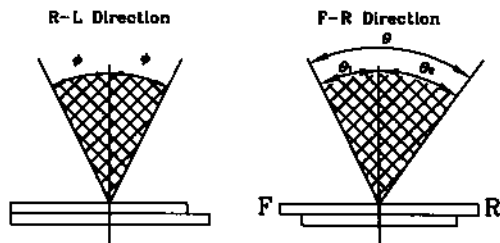
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction is 6 O'clock
So $\theta_1 > \theta_2$

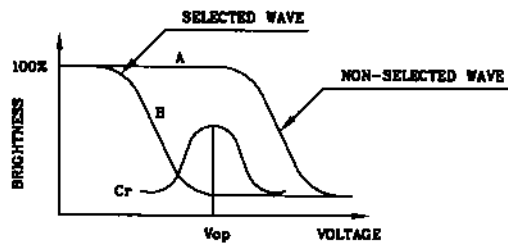
$$\theta = \theta_1 + \theta_2$$

*Conditions

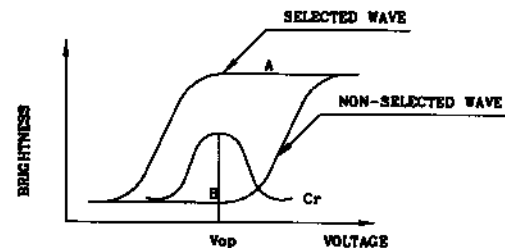
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

JK

REV.:

1.2

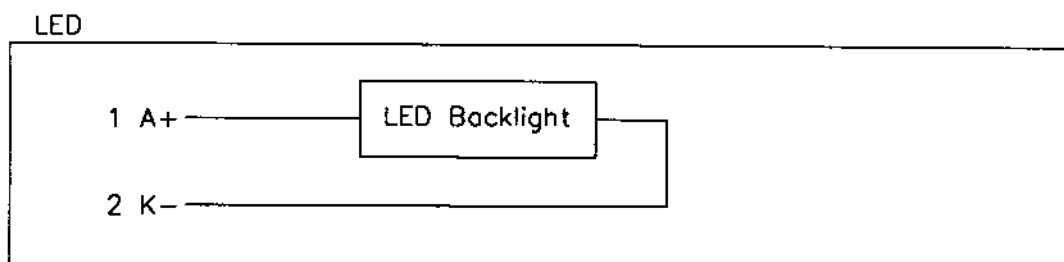
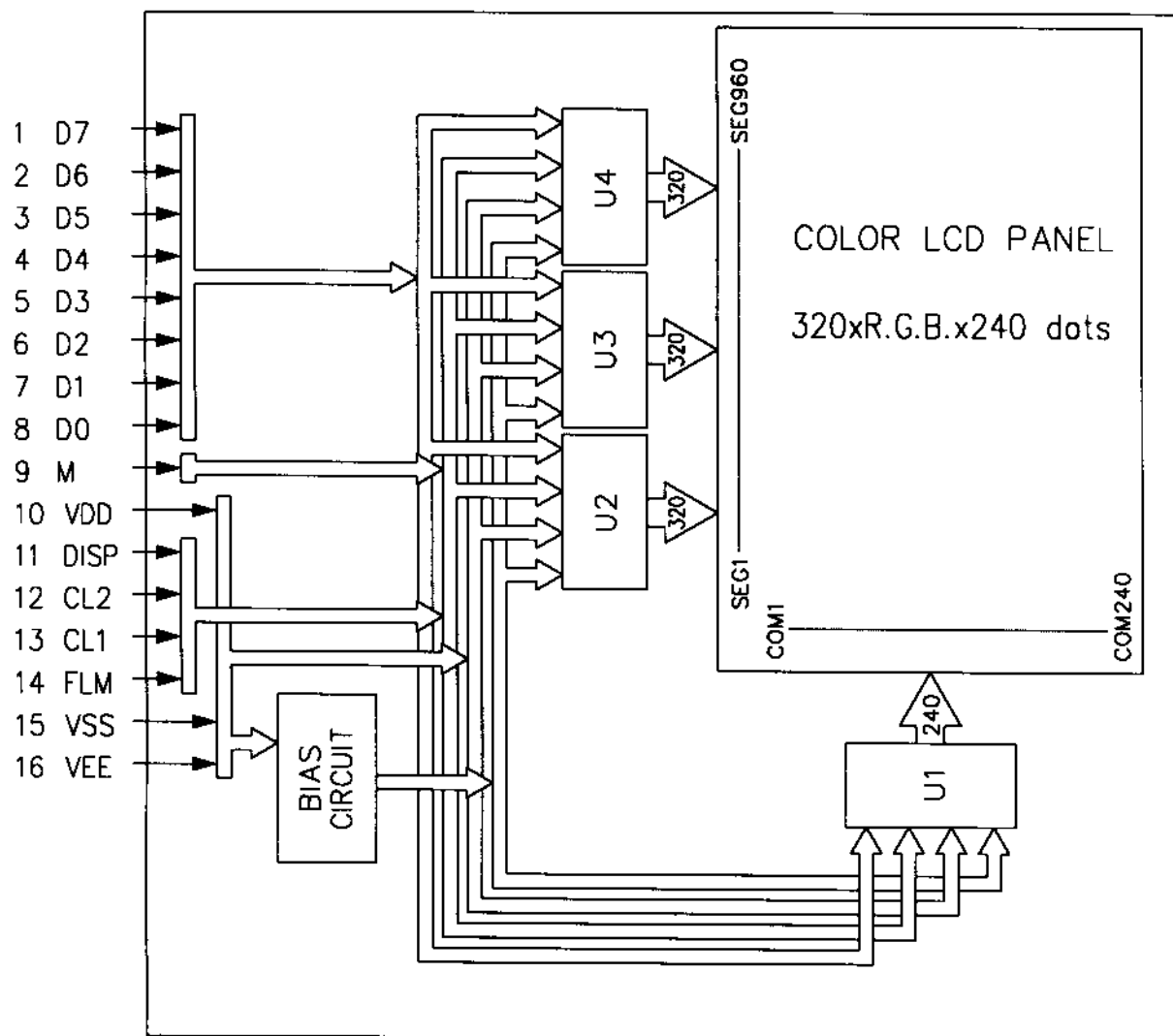
HDM3224CL-S-TF

SHEET 9 OF 19

DATE:

10/20/03

5. BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

LCD

PIN NO	SYMBOL	FUNCTION
1	D7	DISPLAY DATA
2	D6	DISPLAY DATA
3	D5	DISPLAY DATA
4	D4	DISPLAY DATA
5	D3	DISPLAY DATA
6	D2	DISPLAY DATA
7	D1	DISPLAY DATA
8	D0	DISPLAY DATA
9	M	SWITCH SIGNAL TO CONVERT LCD DRIVE WAVEFORM INTO AC
10	V _{DD}	LOGIC SUPPLY VOLTAGE
11	$\overline{\text{DISPOFF}}$	DISPLAY CONTROL L: OFF H: ON
12	CL2	DATA INPUT CLOCK
13	CL1	INPUT DATA LATCH SIGNAL
14	FLM	SCAN START-UP SIGNAL
15	V _{SS}	GROUND
16	V _{EE}	POWER SUPPLY FOR LCD

LED

1	A+	POWER SUPPLY FOR BACKLIGHT (A+)
2	K-	POWER SUPPLY FOR BACKLIGHT (K-)

LCD INTERFACE CABLE

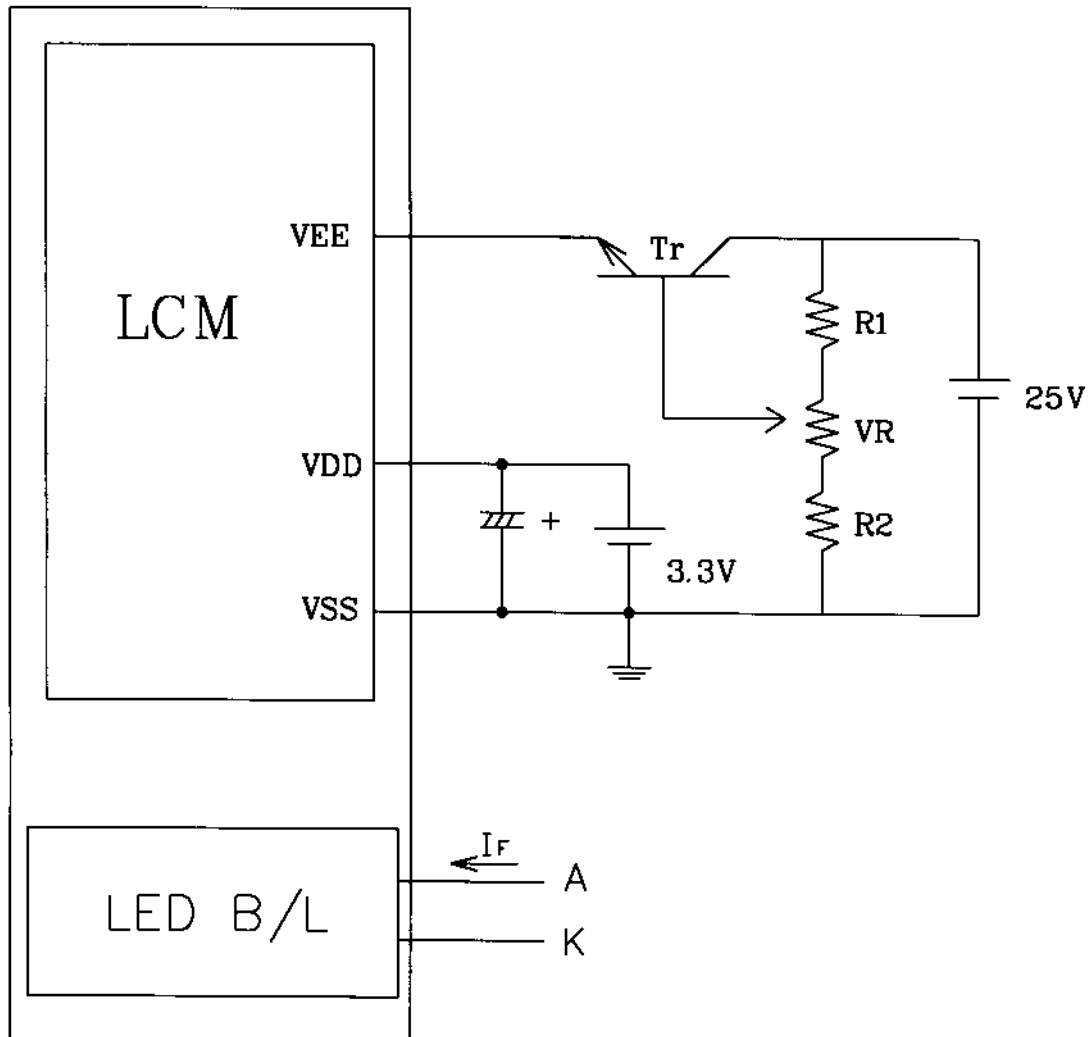
Pitch 0.5mm ,Width 8.5mm/Suitable Connector :52689-1693(molex)

LED CONNECTOR :

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 11 OF 19
				DATE: 10/20/03

7. POWER SUPPLY



1. $R1 + R2 + VR = 10 \sim 20K \Omega$

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 12 OF 19
				DATE: 10/20/03

8.TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

● VDD=3.3V±10%, Ta=-20~70℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CL2 Clock Cycle	tCYC2	Fig.a	182	-	-	ns
CL2 HIGH-LEVEL Width	tCWH2	Fig.a	66	-	-	ns
CL2 LOW-LEVEL Width	tCWL2	Fig.a	85	-	-	ns
Data Set Up Time	tDS2	Fig.a	50	-	-	ns
Data Hold Time	tDH2	Fig.a	50	-	-	ns
CL2 Rise/Fall Time	tr2,tf2	Fig.a	-	-	30	ns
Clock Set Up Time	tSCL	Fig.a	80	-	-	ns
Clock Hold Time	tHCL	Fig.a	80	-	-	ns
M Set Up Time	tMS	Fig.a	20	-	-	ns
M Hold Time	tMH	Fig.a	20	-	-	ns

● VDD=3.3V±10%, Ta=-20~70℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CL1 Clock Cycle	tCYC1	Fig.b	400	-	-	ns
CL1 HIGH-LEVEL Width	tCWH1	Fig.b	25	-	-	ns
CL1 LOW-LEVEL Width	tCWL1	Fig.b	370	-	-	ns
Data Set Up Time	tDS1	Fig.b	100	-	-	ns
Data Hold Time	tDH1	Fig.b	10	-	-	ns
CL1 Rise/Fall Time	tri,tf1	Fig.b	-	-	30	ns

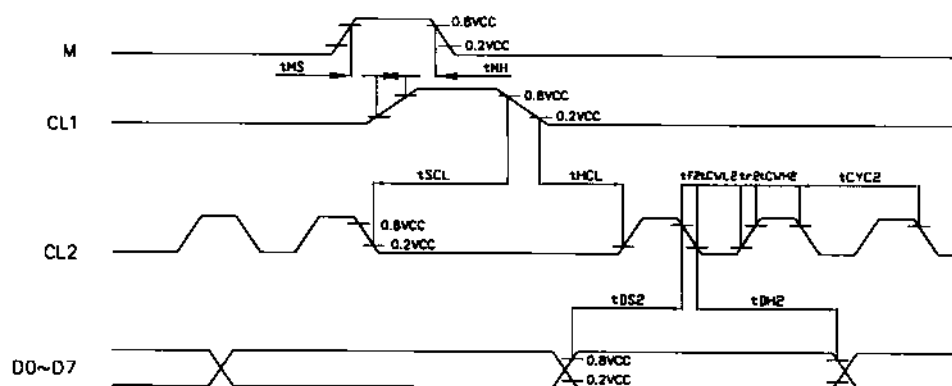


Fig . a Interface timing (SEGMENT)

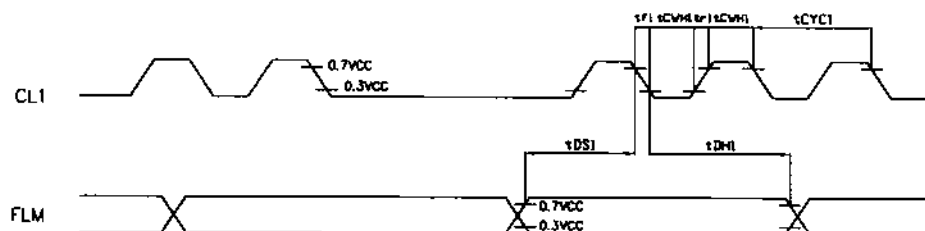


Fig . b Interface timing (COMMON)

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JK

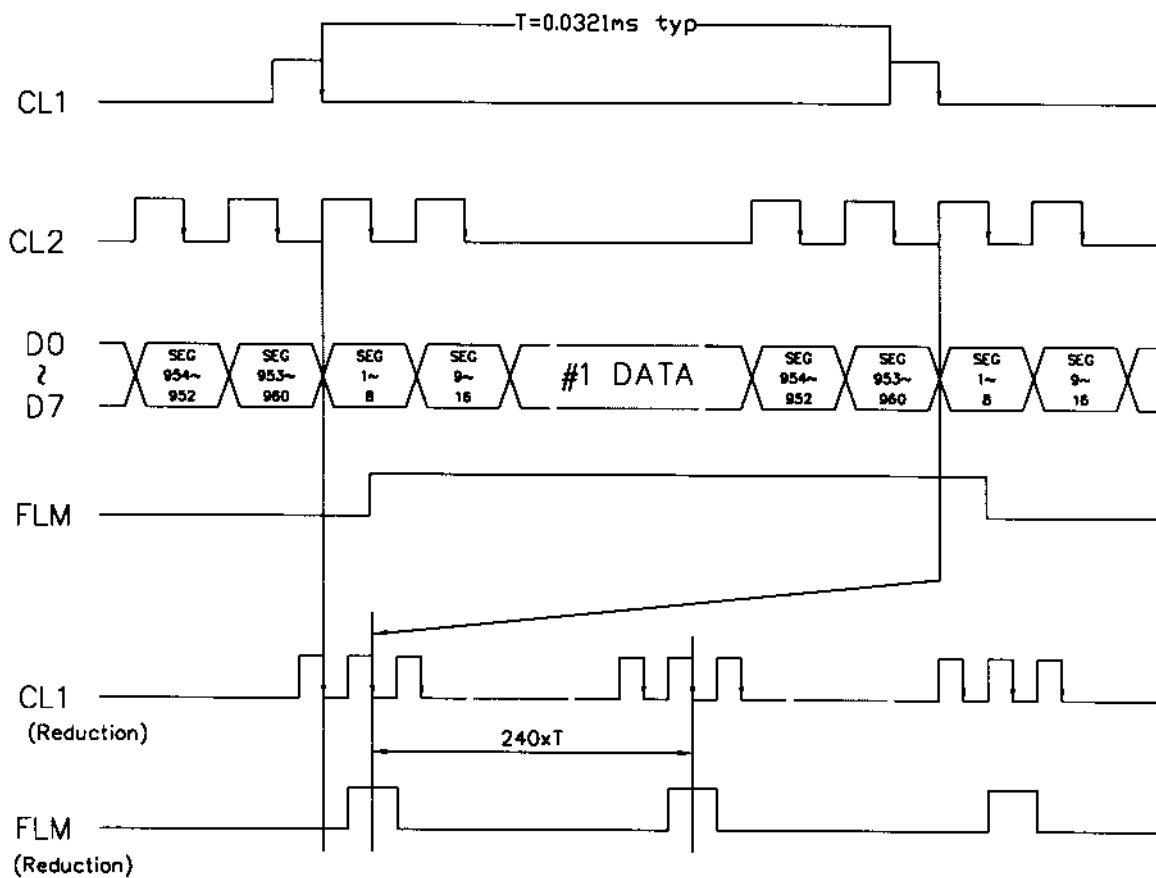
REV.:
1.2

HDM3224CL-S-TF

SHEET 13 OF 19

DATE: 10/20/03

8-2 TIMING CHART OF INPUT SIGNAL



HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JK

REV.:
1.2

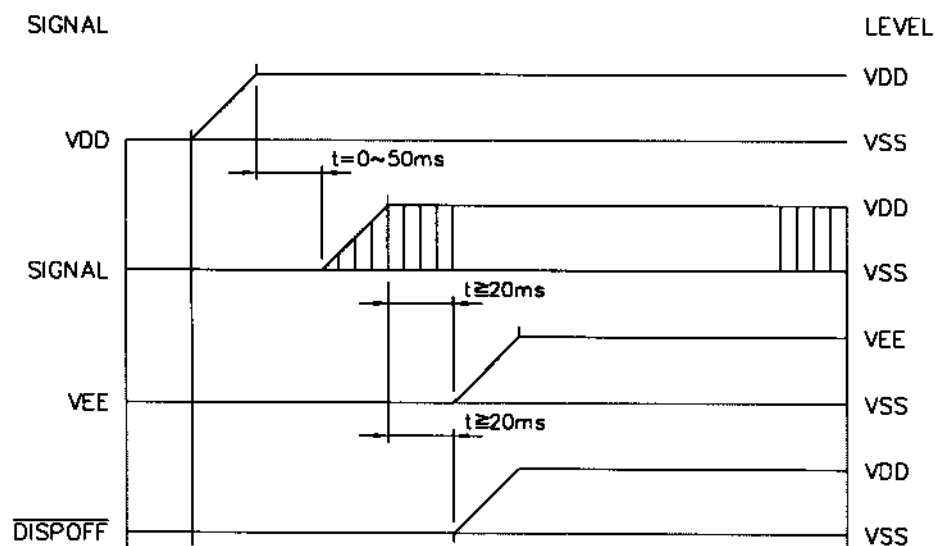
HDM3224CL-S-TF

SHEET 14 OF 19

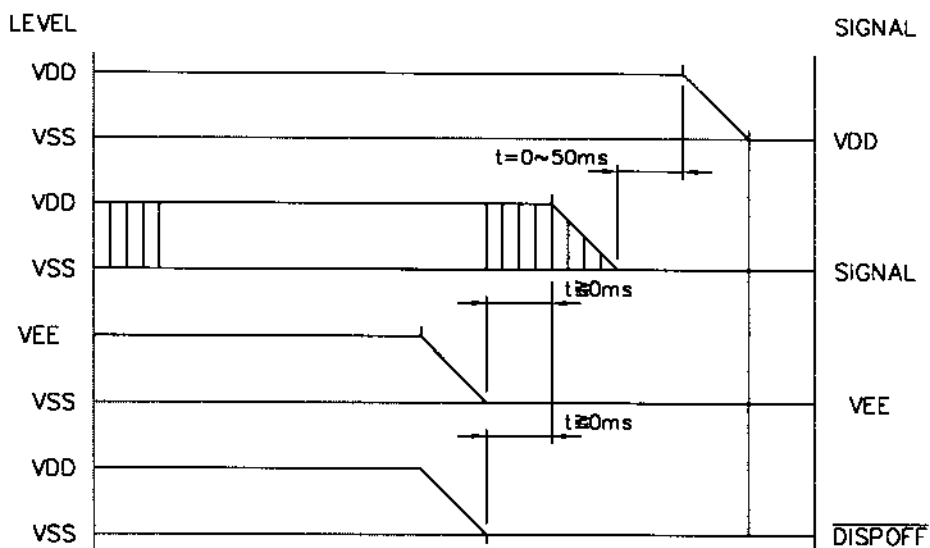
DATE: 10/20/03

8-3. POWER ON/OFF TIMING

ON SEQUENCE



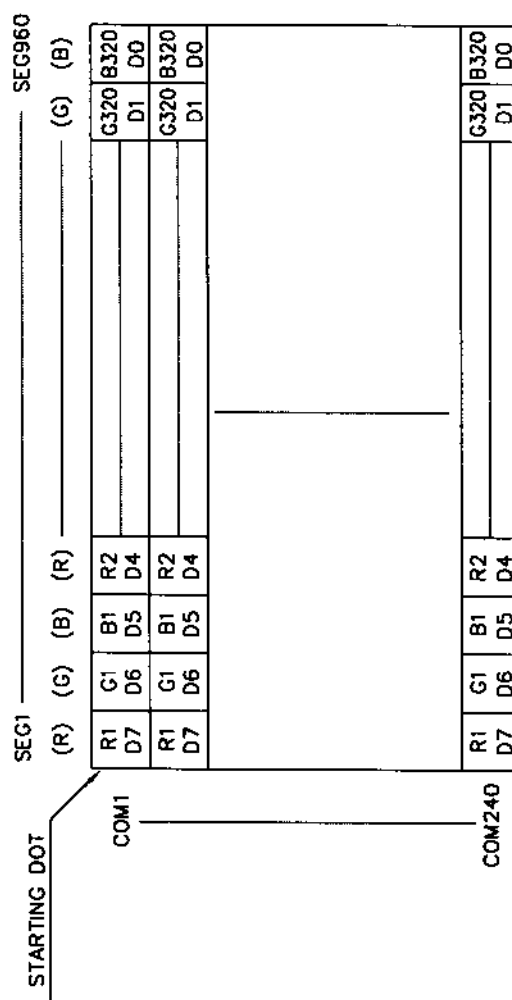
OFF SEQUENCE



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.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 15 OF 19
				DATE: 10/20/03

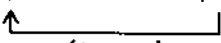
8-4. DISPLAY PATTERN



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

9. RELIABILITY TEST

WIDE TEMPERATURE RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80°C	120Hrs		Appearance without defect	
2	Low Temp. Storage	-40°C	120Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60°C 90%RH	120Hrs		Appearance without defect	
4	High Temp. Operating Display	70°C	120Hrs		Appearance without defect	
5	Low Temp. Operating Display	-20°C	120Hrs		Appearance without defect	
6	Thermal Shock	-20°C, 30min → 70°C, 30min  (1cycle)			Appearance without defect	10 cycles

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JK

REV.:
1.2

HDM3224CL-S-TF

SHEET 17 OF 19

DATE: 10/20/03

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.

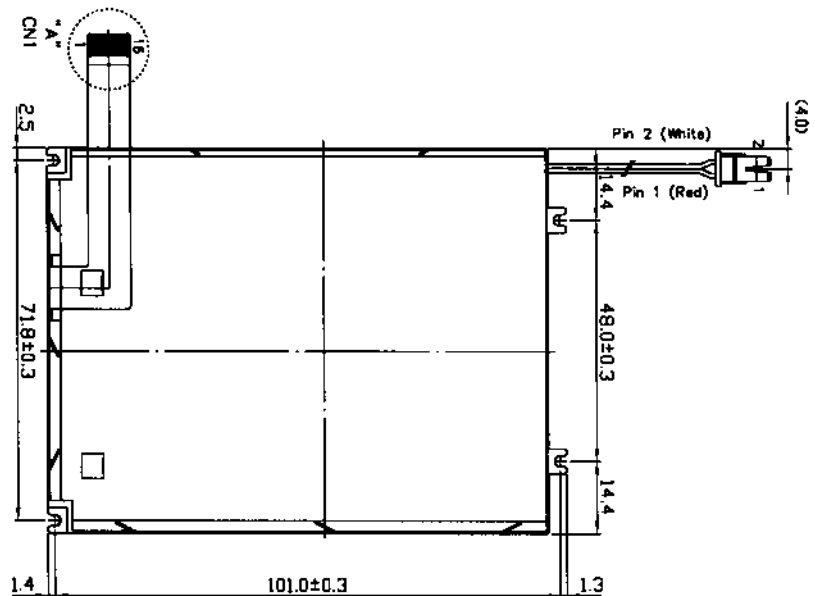
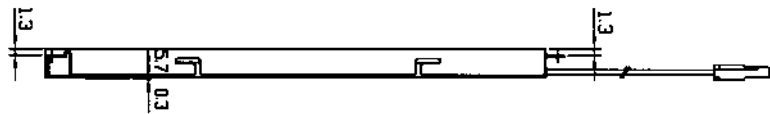
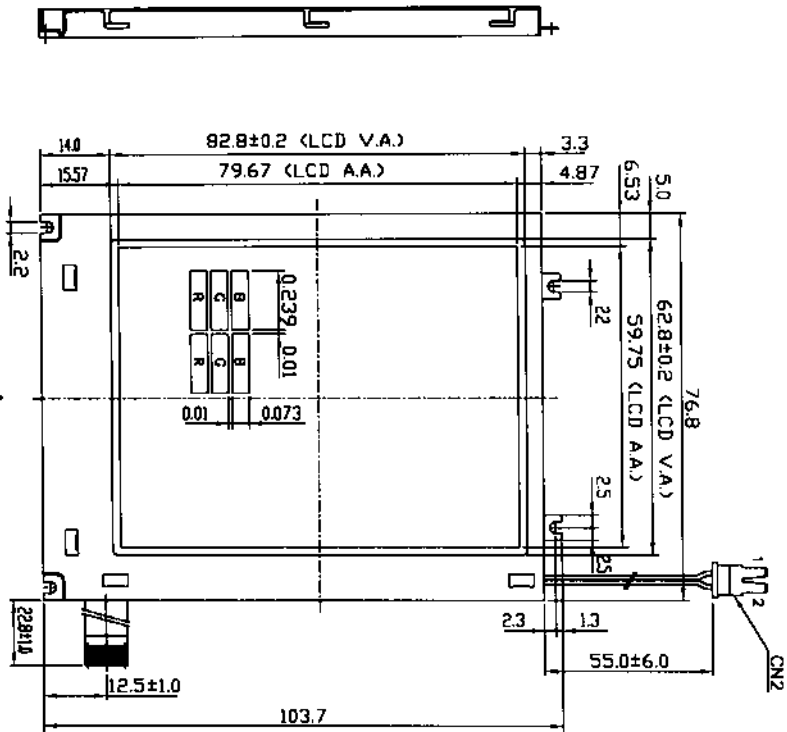
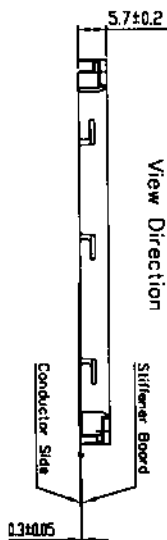
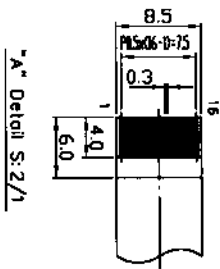
- **TERMS OF WARRANT**

- 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.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.2	HDM3224CL-S-TF	SHEET 18 OF 19
				DATE: 10/20/03

- Notes :
1. Resolution : 240 (H) X 320 (V)(R,G,B) Dots
 2. Backlight : LED (White)
 3. Frame Material : SUS430-2B (0.3 , 0.2mm)

CN1 : FPC CONNECTOR PITCH 0.5mm WIDTH 8.5mm
CN2 : BHSR-02YS-1 (JST)



X1											
Y1				Y2				Y3			
R1	G1	B1	R2	G2	B2	R3	R2	R3		R320	G320
O7	O6	O5	O4	O3	O2	O1	O0	O7		O2	O1
										O0	O0

Display Pattern

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JK

REV.:
1.2

HDM3224CL-S-TF

SHEET 19 OF 19
DATE: 10/20/03