



Industrial Co., Ltd.

DATA SHEET



LCM MODULE

TF177N

Specification for Approval

APPROVED BY	CHECKED BY	PREPARED BY

ISSUED: V00 2010-7-21

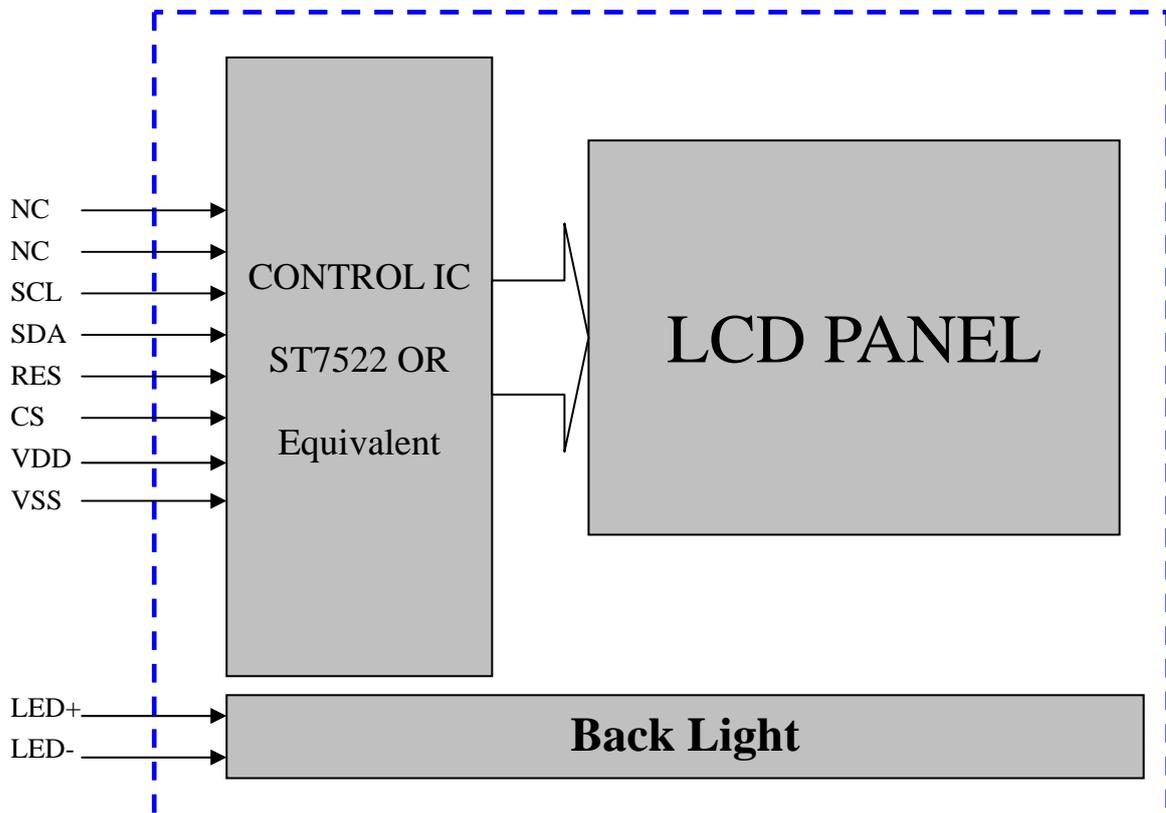
CONTENTS

FUNCTIONS & FEATURES	3
BLOCK DIAGRAM	3
MODULE OUTLINE DRAWING	4
INTERFACE PIN FUNCTIONS	5
ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)	5
DC ELECTRICAL CHARACTERISTICS	5
LED BACKLIGHT CHARACTERISTICS	5
CONNECTION WITH MCU	6
The serial interface	6
Reference circuit examples	7
AC CHARACTERISTICS	8
OPTICAL CHARACTERISTICS	9
COMMAND FUNCTION	11
DISPLAY DATA RAM	13
RESET CIRCUIT	15
RELIABILITY TEST CONDITION	16
PRECAUTION FOR USING LCM MODULE	17
OTHERS	17
APPENDIX A: DATE CODE RULES	18
APPENDIX B: CHANGE NOTES	18

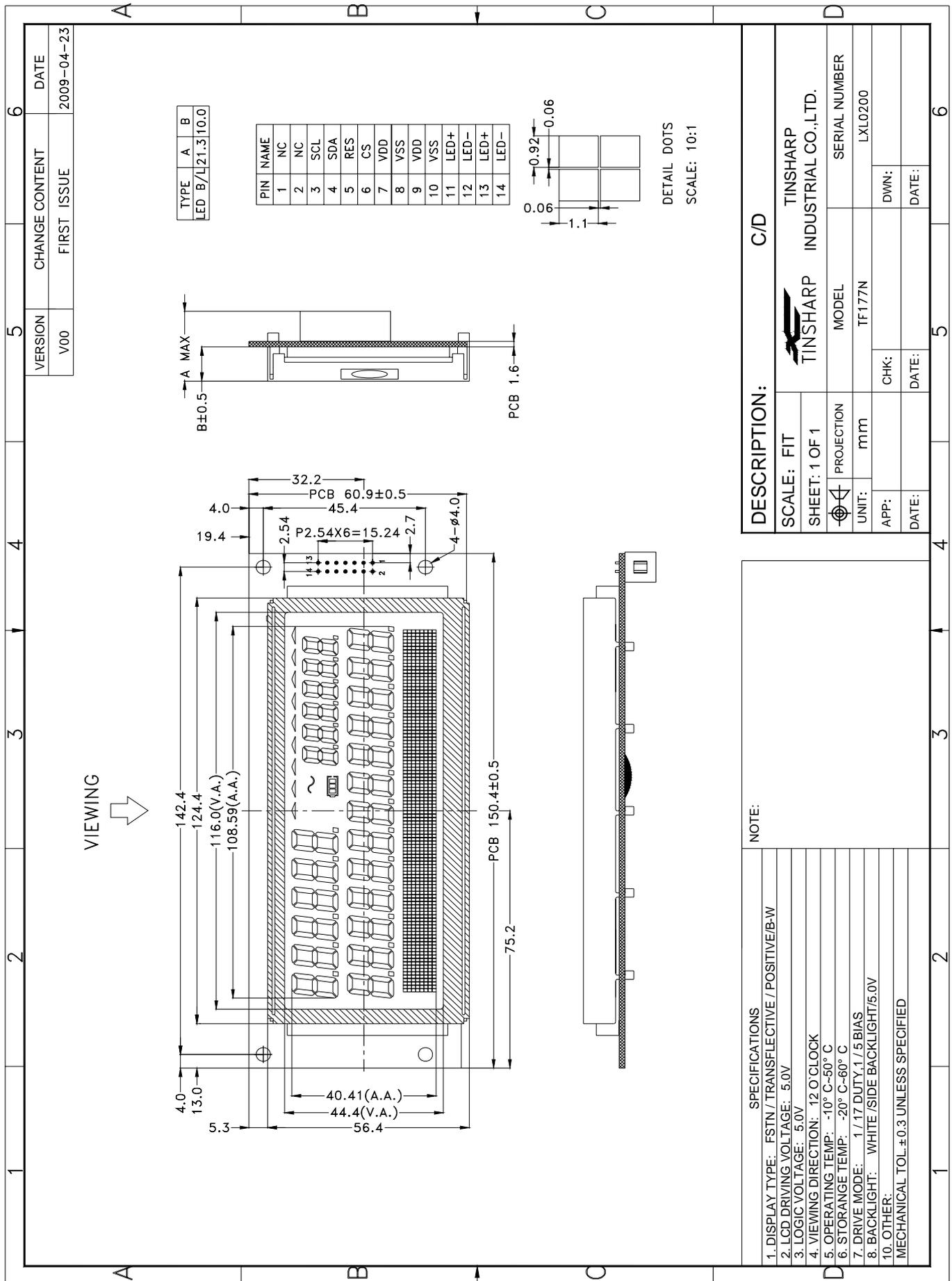
FUNCTIONS & FEATURES

- Construction : COB(Chip-on-Board)
- Display Format : Segment
- Display Type : FSTN, Transflective, Positive, B-W
- Controller : ST7522 or equivalent controller
- Interface : Serial interface
- Backlight : white/side light
- Viewing Direction : 12 O'clock
- Driving Scheme : 1/17 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 V
- V_{LCD} Adjustable For Best Contrast : 5.0 V ($V_{OP.}$)
- Operation temperature : -10°C to +50°C
- Storage temperature : -20°C to +60°C

BLOCK DIAGRAM



MODULE OUTLINE DRAWING



INTERFACE PIN FUNCTIONS

Pin No.	Symbol	Level	Description
1	NC	--	Non-connection.
2	NC	--	Non-connection.
3	SCL	H/L	serial input clock
4	SDA	H/L	serial input data
5	RES	H/L	Input low active. System reset.
6	CS	H/L	Input. When CS = 1 the chip select become active
7	VDD	+5.0v	Power supply for logic operating.
8	VSS	0V	Ground.
9	VDD	--	This terminal is connected to the Pin 7.
10	VSS	--	This terminal is connected to the Pin 8.
11	LED+	+5.0V	Power supply for Back Light.
12	LED-	0V	Ground for Back Light.
13	LED+	--	This terminal is connected to the Pin 11.
14	LED-	--	This terminal is connected to the Pin 12.

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V _{DD}	-0.3	+7.0	V
Supply voltage for LCD	V _o	-7.0	+0.3	V
Input voltage	V _I	0.3	V _{DD} +0.3	V
Normal Operating temperature	T _{OP}	-30	+80	°C
Normal Storage temperature	T _{ST}	-40	+100	°C

Note: Stresses beyond those given in the Absolute Maximum Rating table may cause operational errors or damage to the device. For normal operational conditions see AC/DC Electrical Characteristics.

DC ELECTRICAL CHARACTERISTICS

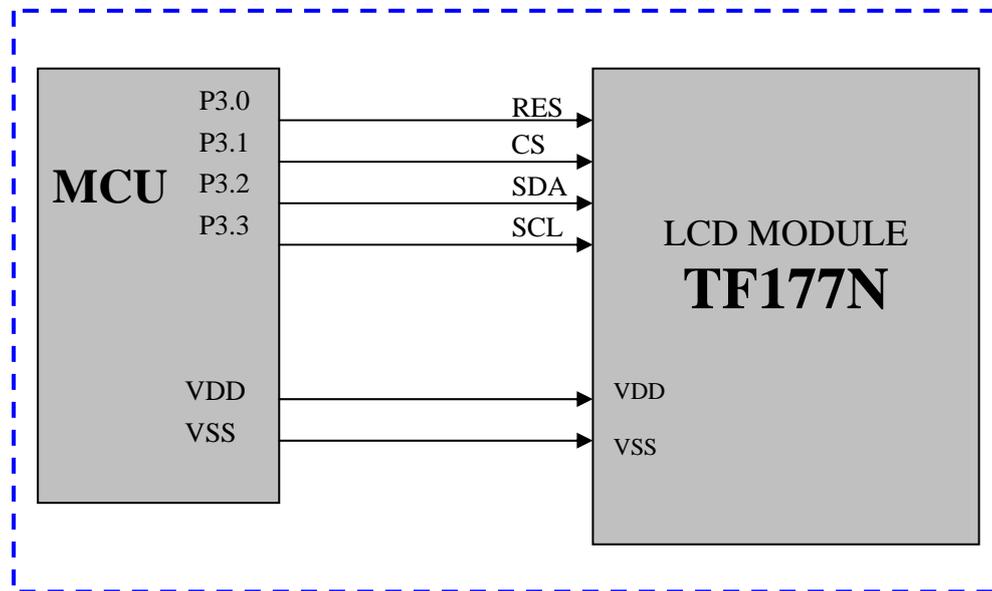
Parameter	Symbol	Condition	Min	T _{YP}	Max	Unit
Supply voltage for logic	VDD	--	4.8	5.0	5.2	V
Supply current for logic	IDD	--	--	31	40	mA
Operating voltage for LCD	VLCD	-20°C				
		+25°C	4.5	4.7	4.9	V
		+70°C				
Input voltage "H" level	VIH	--	0.7VDD	--	VDD	V
Input voltage "L" level	VIL	--	VSS	--	0.2VDD	V

LED BACKLIGHT CHARACTERISTICS

COLOR	Wavelength λ p(nm)	Operating Voltage(±0.15V)	Spectral line half width Δ λ (nm)	Forward Current (mA)
White	--	3.1	--	80

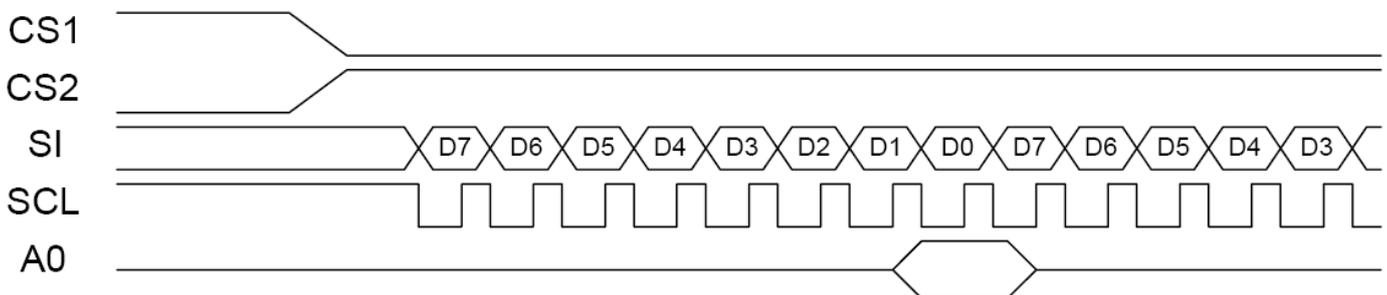
NOTE: Do not connect +5V directly to the backlight terminals. This will ruin the backlight.

CONNECTION WITH MCU



The serial interface

When the serial interface has been selected (P/S = "L") then when the chip is in active state (CS1 = "L" and CS2 = "H") the serial data input (SI) and the serial clock input (SCL) can be received. The serial data is read from the serial data input pin in the rising edge of the serial clocks D7, D6 through D0, in this order. This data is converted to 8 bits parallel data in the rising edge of the eighth serial clock for the processing. The A0 input is used to determine whether or the serial data input is display data or command data; when A0 = "H", the data is display data, and when A0 = "L" then the data is command data. The A0 input is read and used for detection every 8th rising edge of the serial clock after the chip becomes active.



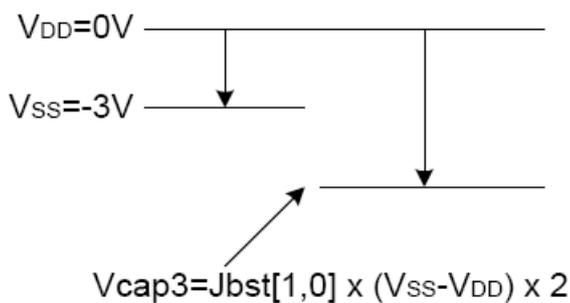
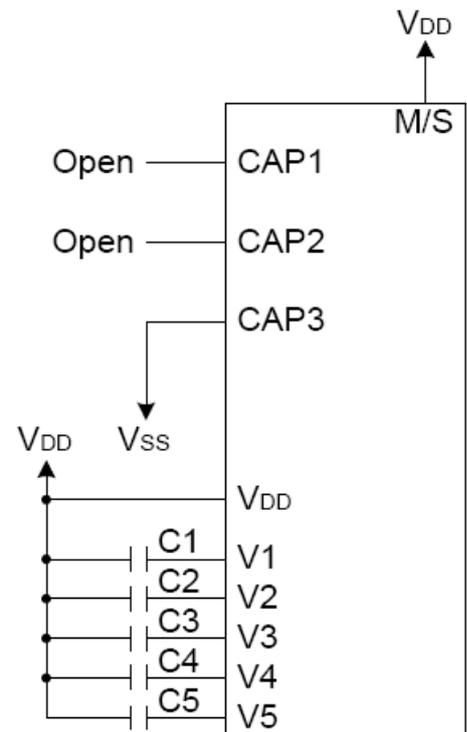
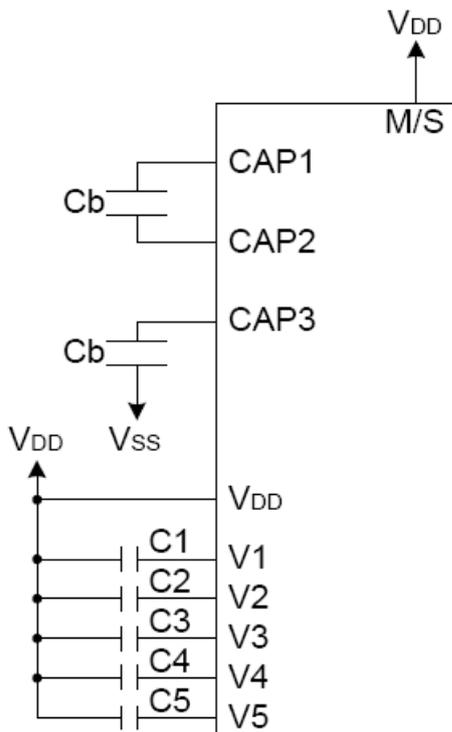
a serial interface signal chart

- * When the chip is not active, the shift registers and the counter are reset to their initial states.
- * Reading is not possible while in serial interface mode.
- * Caution is required on the SCL signal when it comes to line-end reflections and external noise. We recommend that operation be rechecked on the actual equipment.

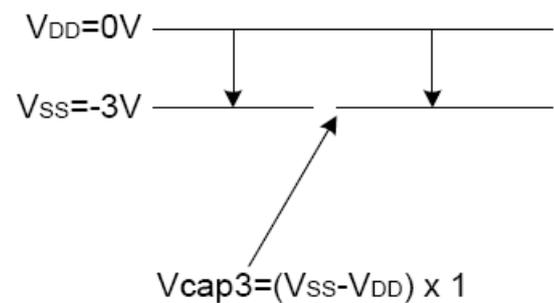
Reference circuit examples:

When used 2x step-up voltage circuit, the “Power control” command must set to 2DH and adjust “Booster input voltage set” command of Vcap3’ s full range.

When used 1x step-up voltage circuit, the “Power control” command must set to 29H; the “Booster input voltage set” command is not action at this operation.



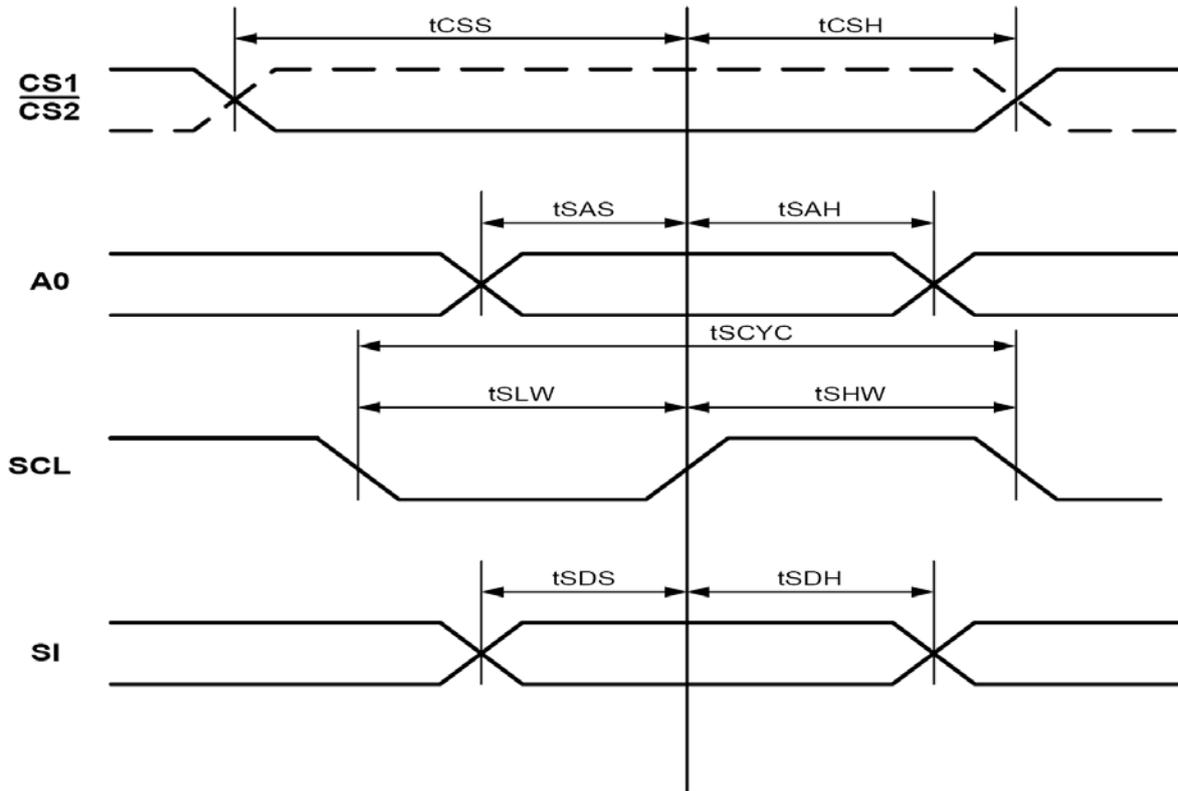
2x step-up voltage circuit
(Power control=2DH)



1x step-up voltage circuit
(Power control=29H)

AC CHARACTERISTICS

SERIAL INTERFACE

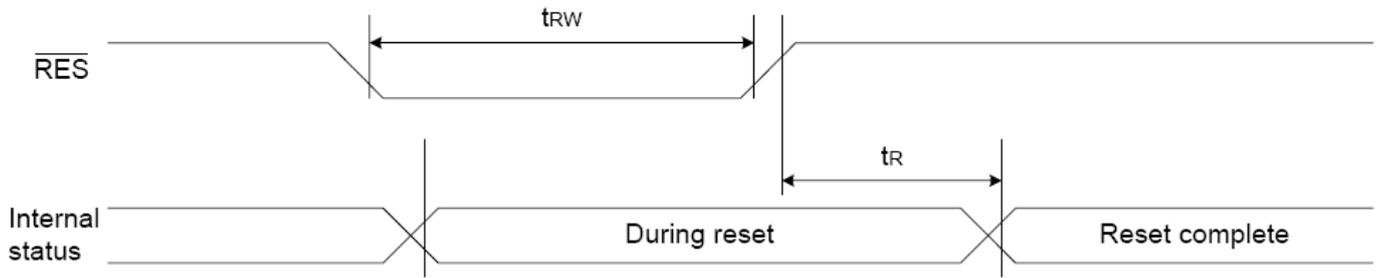


(Ta = -40 to 85°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
Serial Clock Period		tSCYC		500	—	400	—	ns
SCL "H" pulse width	SCL	tSHW	—	100	—	300	—	
SCL "L" pulse width		tSLW		200	—	120	—	
Address setup time	A0	tsAS	—	0	—	0	—	ns
Address hold time		tsAH		100	—	100	—	
Data setup time	SI	tSDS	—	0	—	0	—	ns
Data hold time		tSDH		120	—	100	—	
CS-SCL time	CS	tcSS	—	60	—	40	—	ns
		tCSH		2200	—	1000	—	

*1 All timing is specified using 20% and 80% of VDD as the standard.

Reset Timing

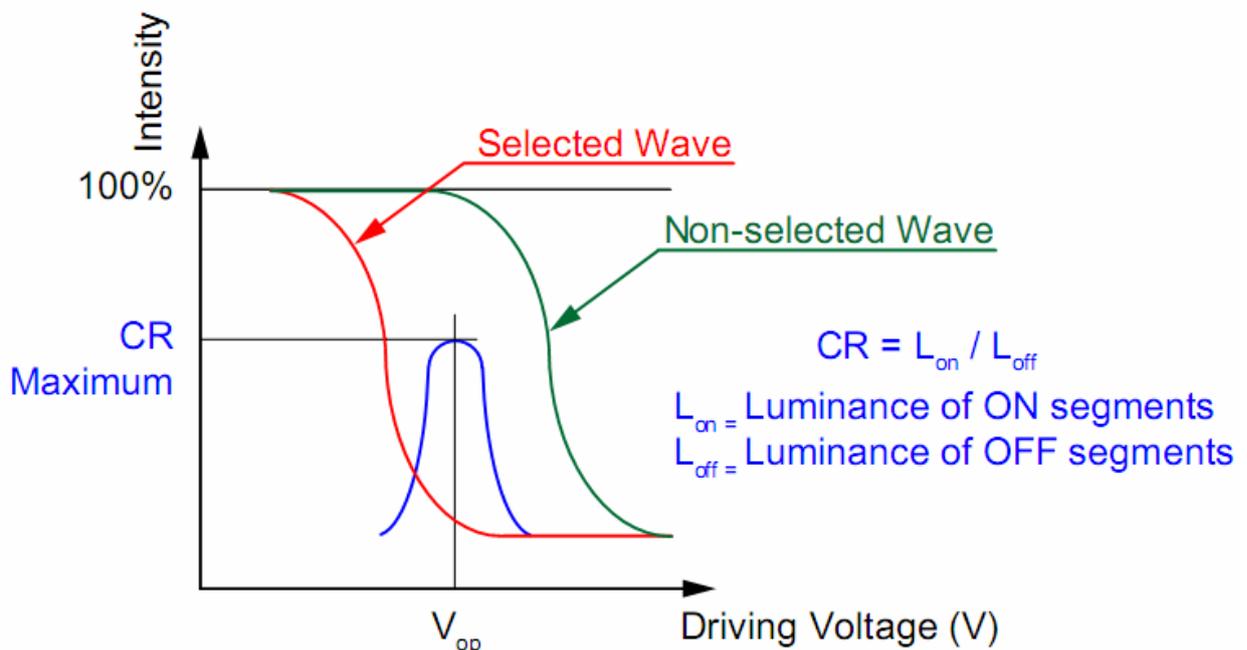


Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time	—	t_R	—	—	1	100	μs
Reset "L" pulse width	RES	t_{RW}	—	0.2	1	—	μs

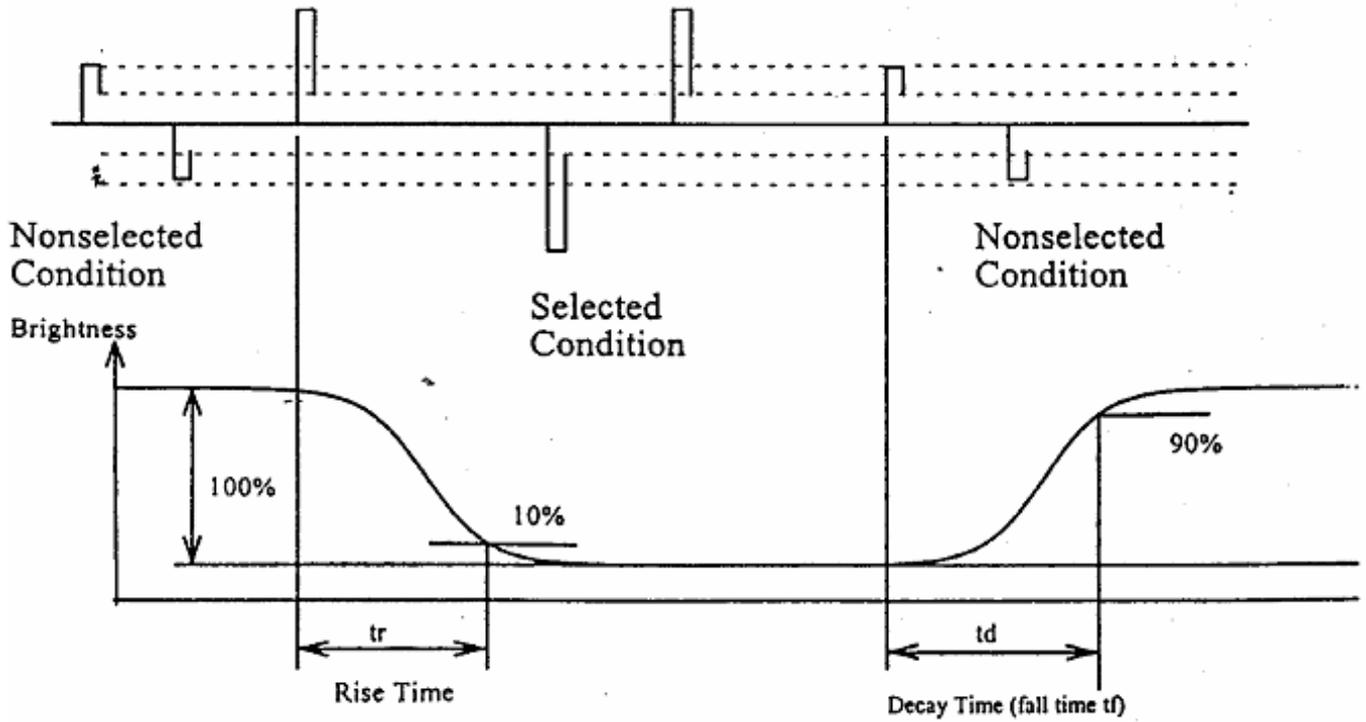
*1 When double chip was be used, then the duty set command must be set between the t_R

OPTICAL CHARACTERISTICS

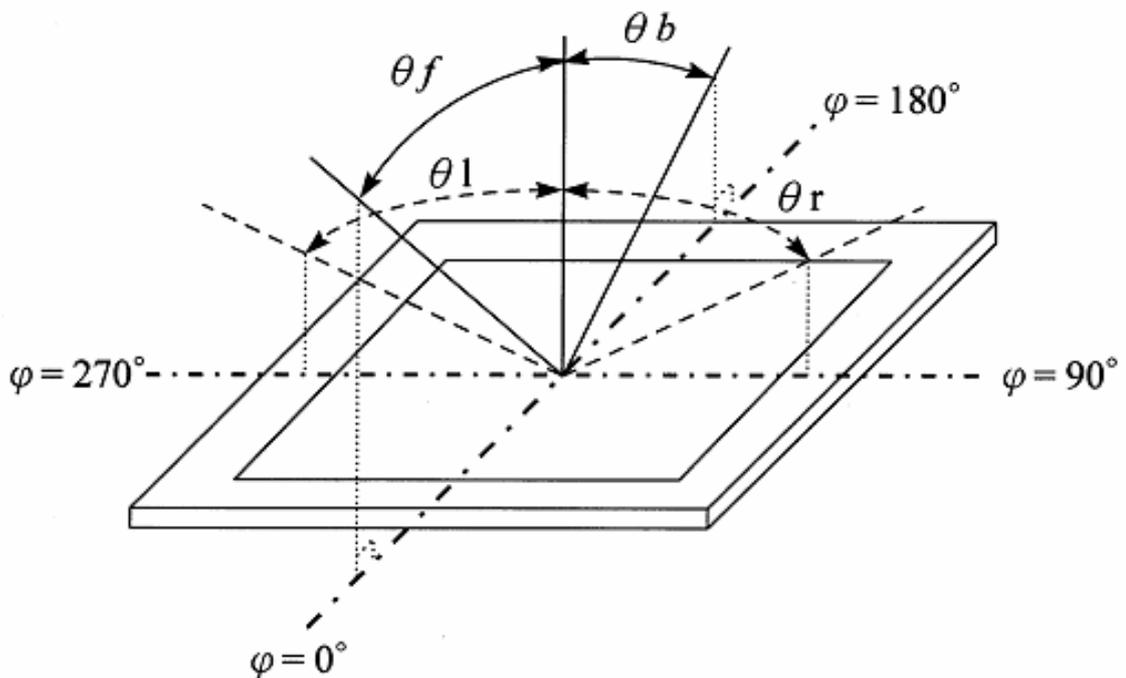
Note1: Definition Operation Voltage (V_{OP})



Note2: Response time



Note3: Viewing angle



COMMAND FUNCTION

Instructions	Instruction code											Function
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
Display on/off	0	1	0	1	0	1	0	1	1	1	D	D=1:Display on D=0:Display off
Page address set	0	1	0	1	0	1	1	Page address				Set display page
Column address set upper bits	0	1	0	0	0	0	1	MSB 4 bits				Set MSB 4 bits of column address
Column address set lower bits	0	1	0	0	0	0	0	LSB 4 bits				Set LSB 4 bits of column address
Status read	0	0	1	0	Status			0	0	0	0	Read status
Display data write	1	1	0	Write data								Write display data
Display data read	1	0	1	Read data								Read display data
Start line set	0	1	0	0	1	0	Display start address					Determines the RAM display line for COM 0
ADC select	0	1	0	1	0	1	0	0	0	0	A	Display RAM and Segment output correspondence A=1:Reverse A=0:Normal
Display normal/reverse	0	1	0	1	0	1	0	0	1	1	R	Set LCD display reverse R=1:Reverse R=0:Normal
Display all point on/off	0	1	0	1	0	1	0	0	1	0	L	Set display all point on L=1:All on L=0:Normal
Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment Wr:+1 Rd:+0
End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
Duty select	0	1	0	1	0	1	0	1	0	0	U	Select LCD duty U=1:1/33 duty U=0:1/17 duty
LCD bias set	0	1	0	1	0	1	0	0	0	1	I	Select LCD bias voltage I=1:1/5 bias I=0:1/6 bias
Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
Power control	0	1	0	0	0	1	0	1	B	0	F	B=1:Booster on B=0:Booster off F=1:Follower on F=0:Follower off

Instructions	Instruction code											Function
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
Electronic contrast set	0	1	0	1	0	0	0	0	0	0	1	Set contrast by 64 level (V5 fine adjust)
				0	0	Electronic volume						
OSC Frequency set	0	1	0	1	1	1	1	0	0	0	1	Internal OSC frequency adjust
				0	0	0	0	josc 3	josc 2	josc 1	josc 0	
Follower input voltage set	0	1	0	1	1	1	1	1	0	0	0	V5 follower input voltage select(V5 coarse adjust)
				0	0	0	0	0	0	jvref 1	jvref 0	
Follower amplified ratio	0	1	0	0	0	1	0	0	rarb 2	rarb 1	rarb 0	V5 follower amplified ratio
Booster input voltage set	0	1	0	1	1	1	1	0	0	0	0	Booster input voltage select
				jbst 1	jbst 0	0	0	0	0	0	0	
Static indicator on/off static indicator register set	0	1	0	1	0	1	0	1	1	0	S	S=1:Indicator on S=0:Indicator off Set the individual indicator on/off
				0	0	0	0	S4	S3	S2	S1	
Sleep	Display off + Display all point on + Static indicator off compound command											Sleep mode
Stand by	Display off + Display all point on + Static indicator on compound command											Stand by mode

Page Address				Data	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	.....	SEG87	SEG88	SEG89	SEG90	SEG91	SEG92	SEG93	SEG94	SEG95	SEG						
D3	D2	D1	D0																					COM						
0	0	0	0	D0	█	█	█	█	█					Page 0										COM0						
				D1		█	█	█																			COM1			
				D2			█	█	█																			COM2		
				D3				█	█	█																			COM3	
				D4					█	█	█																			COM4
				D5						█	█																			COM5
				D6							█	█																		COM6
				D7								█	█																	
0	0	0	1	D0	█	█	█	█	█					Page 1											COM8					
				D1		█	█	█																				COM9		
				D2			█	█	█																				COM10	
				D3				█	█	█																			COM11	
				D4					█	█	█																			COM12
				D5						█	█																			COM13
				D6							█	█																		COM14
				D7								█	█																	COM15
0	0	1	0	D0		█	█	█					Page 2												COM16					
				D1			█	█	█																				COM17	
				D2				█	█	█																				COM18
				D3					█	█	█																			COM19
				D4						█	█																			COM20
				D5							█	█																		COM21
				D6								█		█																COM22
				D7										█	█															COM23
0	0	1	1	D0	█	█	█	█	█				Page 3												COM24					
				D1		█	█	█																					COM25	
				D2			█	█	█																					COM26
				D3				█	█	█																				COM27
				D4					█	█																				COM28
				D5						█	█																			COM29
				D6							█	█																		COM30
				D7								█		█																COM31
1	0	0	0	D0									Page 8											COMI						
COLUMN				ADC=0	00	01	02	03	04	05	06	07	08	.....	87	88	89	90	91	92	93	94	95							
				ADC=1	95	94	93	92	91	90	89	88	87	.....	08	07	06	05	04	03	02	01	00							

Figure 4

RESET CIRCUIT

When the RES input comes to the "L" level, these LSIs return to the default state. Their default states are as follows:

1. Display OFF
2. Static drive is turned OFF.
3. ADC select: Normal (ADC command D0 = 0)
4. Display all point on is select to normal
5. Display normal/reverse is select to normal
6. Power control register: (D2, D0) = (0, 0)
7. Serial interface internal register data clear
8. 1/6 bias is selected
9. 1/17 duty is selected.
10. Read modify write OFF
11. Column address set to Address 0
12. Page address set to Page 0
13. Start line set to first line
14. Electronic contrast register = 35H(max:3FH)
15. OSC frequency set = 08H
16. Follower input voltage set =02H
17. Follower amplified ratio = 06H
18. Booster input voltage set = 00H

When the power is turned on, the IC internal state becomes unstable, and it is necessary to initialize it using the RES terminal. After the initialization, each input terminal should be controlled normally.

While RES is "L," the oscillator works but the display timing generator stops, and the CL, FR, terminals are fixed to "H." The terminals D0 to D7 are not affected.

RELIABILITY TEST CONDITION

No.	TEST Item	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage Temperature for a long time.	60° C 96hrs	-----
2	Low temperature storage	Endurance test applying the low storage Temperature for a long time	-20° C 96hrs	-----
3	High temperature operation	Endurance test applying the electric stress (Voltage & current)and the thermal stress to the element for a long time	50° C 96hrs	-----
4	Low temperature operation	Endurance test applying the electric stress Under low temperature for a long time	-10° C 96hrs	-----
5	High temperature/ Humidity storage	Endurance test applying the electric stress(Voltage & current) and Temperature/ Humidity stress to the element for a long time	40° C 90%RH 96hrs	
6	High temperature/ Humidity operation	Endurance test applying the electric stress (voltage & current)and temperature/ humidity stress to the element for a long time	40° C 90%RH 96hrs	
7	Temperature cycle	Endurance test applying the low and high temperature cycle. -10° C →25° C→50° C 30min←5min←30min.(1 cycle)	-10° C/50° C 10 cycle	-----

Supply voltage for logic system = 5V. Supply voltage for LCD system = Operating voltage at 25° C.

Mechanical Test

Vibration test	Endurance test applying the vibration during transportation and using	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hour	
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G half sign wave 11 msede 3 times of each direction	
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air	115mbar 40hrs	
Static electricity test	Endurance test applying the electric stress to the terminal	VS=800V,RS-1.5K Ω CS=100pF, 1 time	

Environmental condition

The inspection should be performed at the 1metre height from the LCD module under 2 pieces of 40W white fluorescent lamps (Normal temperature 20~25°C and normal humidity 60±15%RH).

PRECAUTION FOR USING LCM MODULE

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

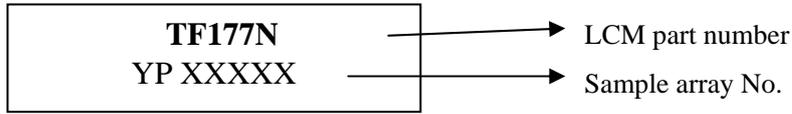
OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules :
 - Exposed area of the printed circuit board
 - Terminal electrode sections

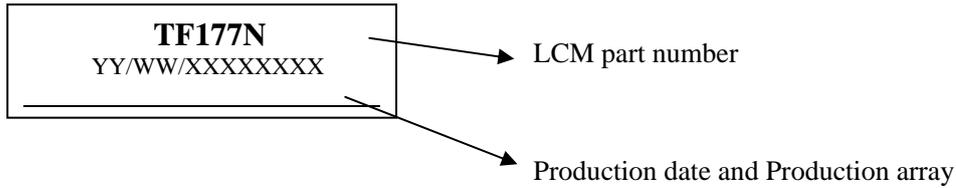
A. DATE CODE RULES

A.1. DATE CODE FOR SAMPLE

YP: meaning sample



A.2. DATE CODE FOR PRODUCTION



A. **TF177N** represents LCM part number

C. YY/WW represents Year, Week

YY—Year WW—Week

XXXXXXXX—Production array No.

B. CHANGE NOTES:

Ver.	Descriptions	Editor	Date
V00	First Issue	HXY	2010-7-21