

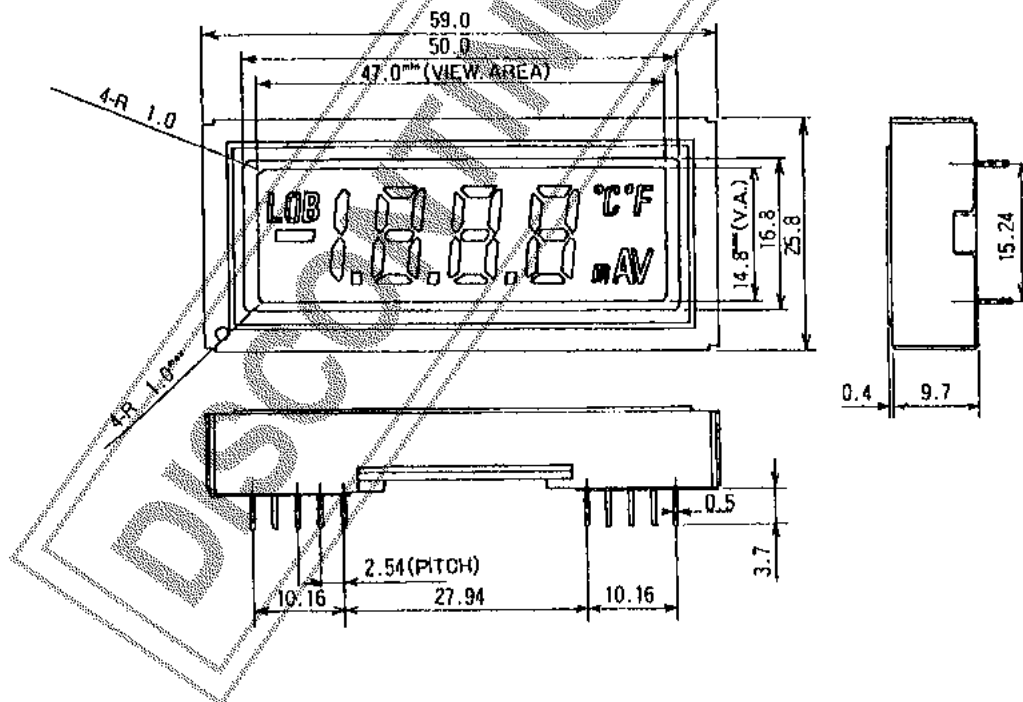
Digital Panel Module

Overview

The Sanyo TM600 is a digital panel display module suitable for a wide range of applications. It incorporates the LCD9031R liquid crystal cell and the 7542A A/D converter and LCD driver IC. The TM600 has a 20-pin DIP configuration for easy mounting on a printed circuit board. The whole module is approximately the same size as the liquid crystal cell alone, simplifying equipment design and installation. The TM600 has low current consumption of 15mA(typ) and a built-in voltage regulator which allows a wide 5 to 9V operating power supply range. These features and single-supply operation make the TM600 ideal for use in portable battery-operated equipment.

Features

- Compact, lightweight module assembly
- 3.1/2 digit A/D converter
- Complete auto-zeroing function
- Range hold and data hold
- Pin-selectable decimal point location
- Low battery indicator

Dimensions
(unit: mm)

Specifications and information herein are subject to change without notice.

TM600

Absolute Maximum Ratings

			unit
Applied Voltage	Vmax	12	V
Operating Temperature	Topg	-5 to +50	°C
Storage Temperature	Tstg	-20 to +60	°C

Electrical Characteristics

(Clock frequency = 32.7kHz, Ta = 23°C, unless otherwise noted)

			min	typ	max	unit
Supply Voltage	VDD			0		V
	VSS		-9.0	-7.0	-5.0	V
Supply Current	IDD	VDD = 0V, VSS = -9V		1.5	3.0	mA
Input Voltage	VIN		-1.0		0	V
	VIL		VSS		VSS + 1	V
Input Impedance	ZIM		0.5	5.0		mΩ
Output Current	I _{ON}	VO = VDD - 0.75V	0	35.0		μA
	I _{OL}	VO = VSS + 0.75V	10.0	35.0		μA
Oscillator Frequency	fosc		29.5	32.7	36.0	kHz
Reference Voltage				1.0		V
Temperature Drift	Vref				400	PPM/°C
Supply Dependency				1.5	2.5	mV/V
Linearity					±0.4	%FS
Zero Drift					10	μV/°C
Sample Time				100		msec
Sample Rate				2		time/sec

DISCONTINUED PRODUCT

TM600

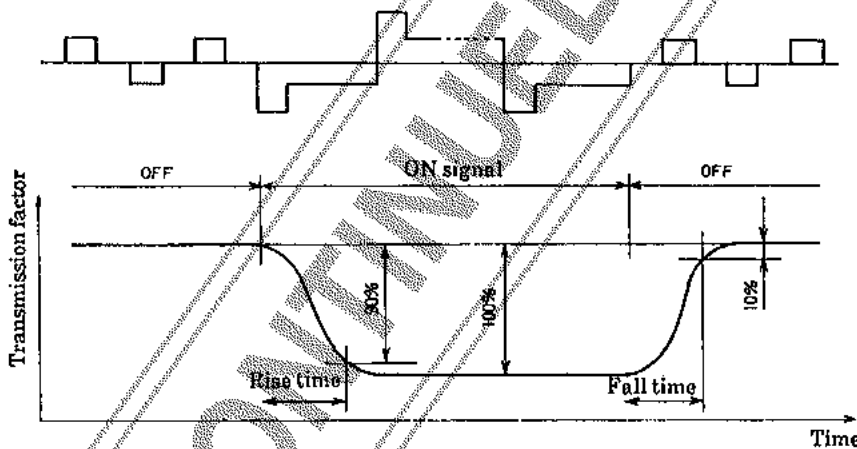
Electro-optical Characteristics at Ta = 25°C

			min	typ	max	unit
Operating Voltage	Vap		2.8	3.1	3.4	V
Response Times Rising	ton	25°C, 3.0V, o-p10'OFF - 90%		150	300	msec
		-10°C, 3.0V, o-p10'OFF - 90%		550	1000	msec
Response Times Falling	toff	25°C, 3.0V, o-p10'ON - 10%		150	300	msec
		-10°C, 3.0V, o-p10'ON - 10%		450	900	msec
Contrast Selected	Con	25°C, 3.0V, o-p10'	90	95		%
		10°C, 3.0V, o-p10'	80	90		%
Contrast Deselected	Coff	25°C, 3.0V, o-p40'		10	20	%
		50°C, 3.0V, o-p40'		30	40	%
Viewing Angle	φ1	3V	0		40	°
Up-Down Direction						
Viewing Angle	φ2	3V	-30		30	°
Left-Right Direction						

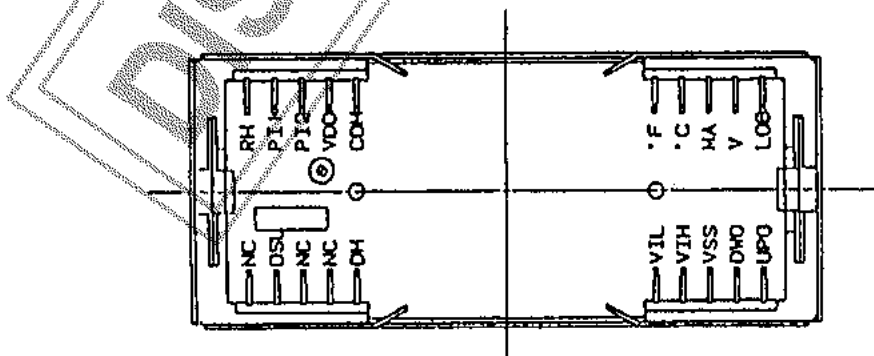
Response times

Rise time : The time required for the contrast to increase from 0% to 90% when the drive signal is switched from OFF to ON.

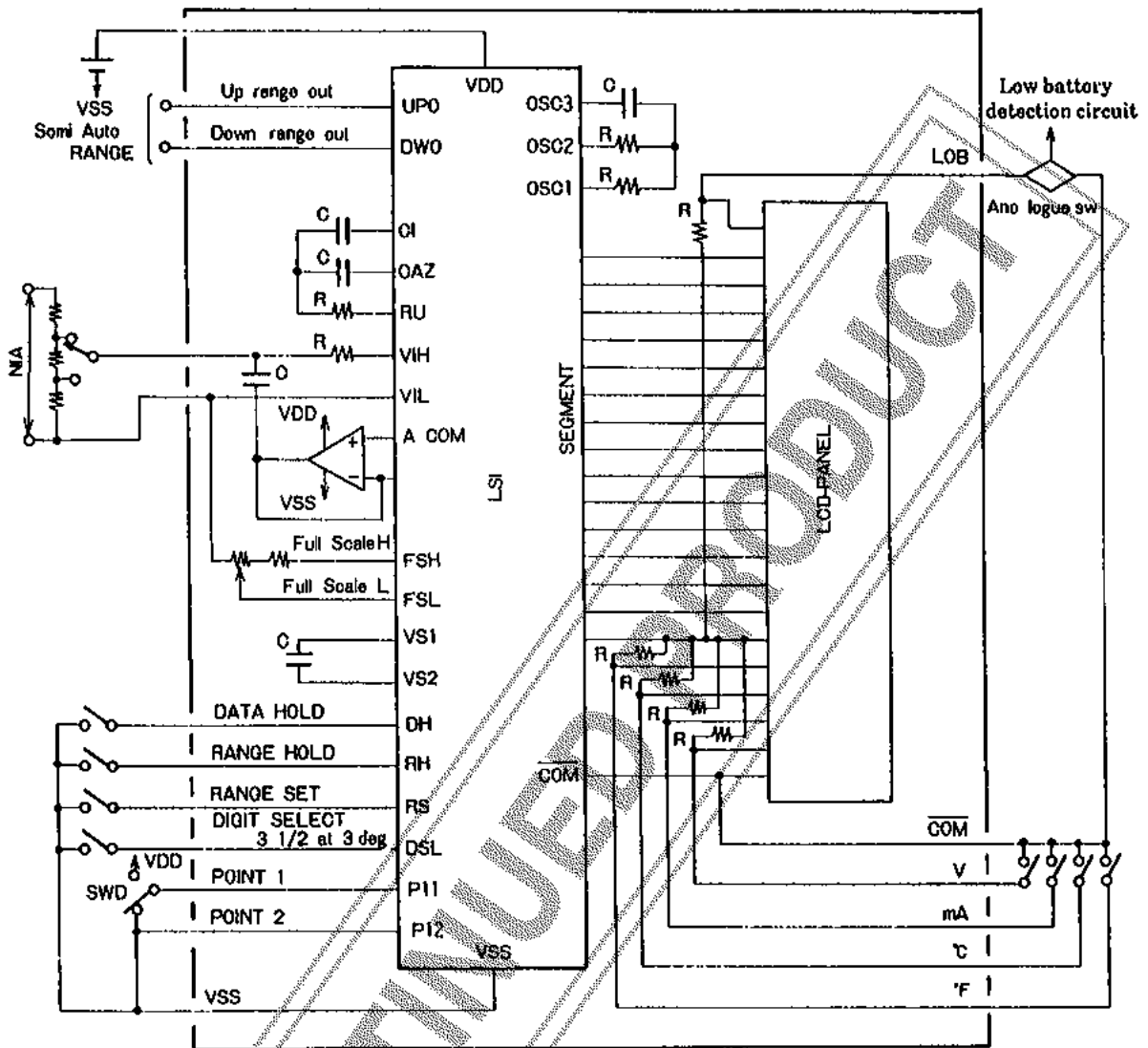
Fall time : The time required for the contrast to decrease from 100% to 10% when the drive signal is switched from ON to OFF.



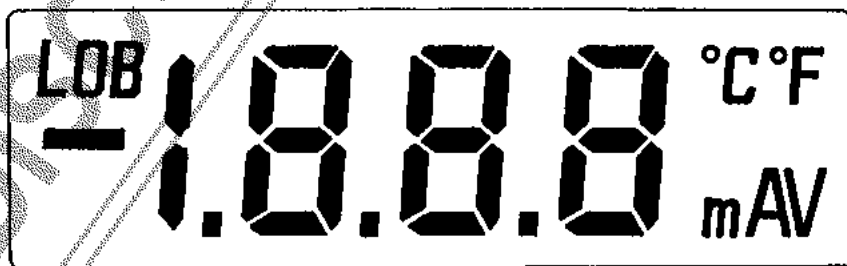
Pinout



Internal Circuit



Display Configuration



Functional Description

1) Power-on Reset

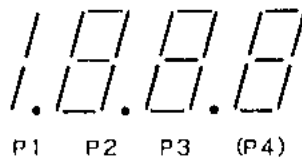
When the power is switched on, both the up range output terminal (UPO) and the down range output terminal (DWO) are held HIGH for several tens of milliseconds. Power-on reset is therefore indicated by both UPO and DWO being HIGH. The module can be set for a predetermined range on power-on.

2) 3.1/2 or 3-digit Selection

Either 3.1/2 or 3-digit A/D conversion can be selected. Grounding the digit selection pin, DSL, selects 3-digit operation. In this mode, the module overflows on a count of 1000. The range drops down on a count of 90.

3) Decimal Point Selection

The position of the decimal point is selected by the decimal point selection inputs, P11 and P12. P4 indicates that no decimal point is displayed.



POINT	P11	P12
P1	0	0
P2	1	0
P3	0	1
(P4)	1	1

Note

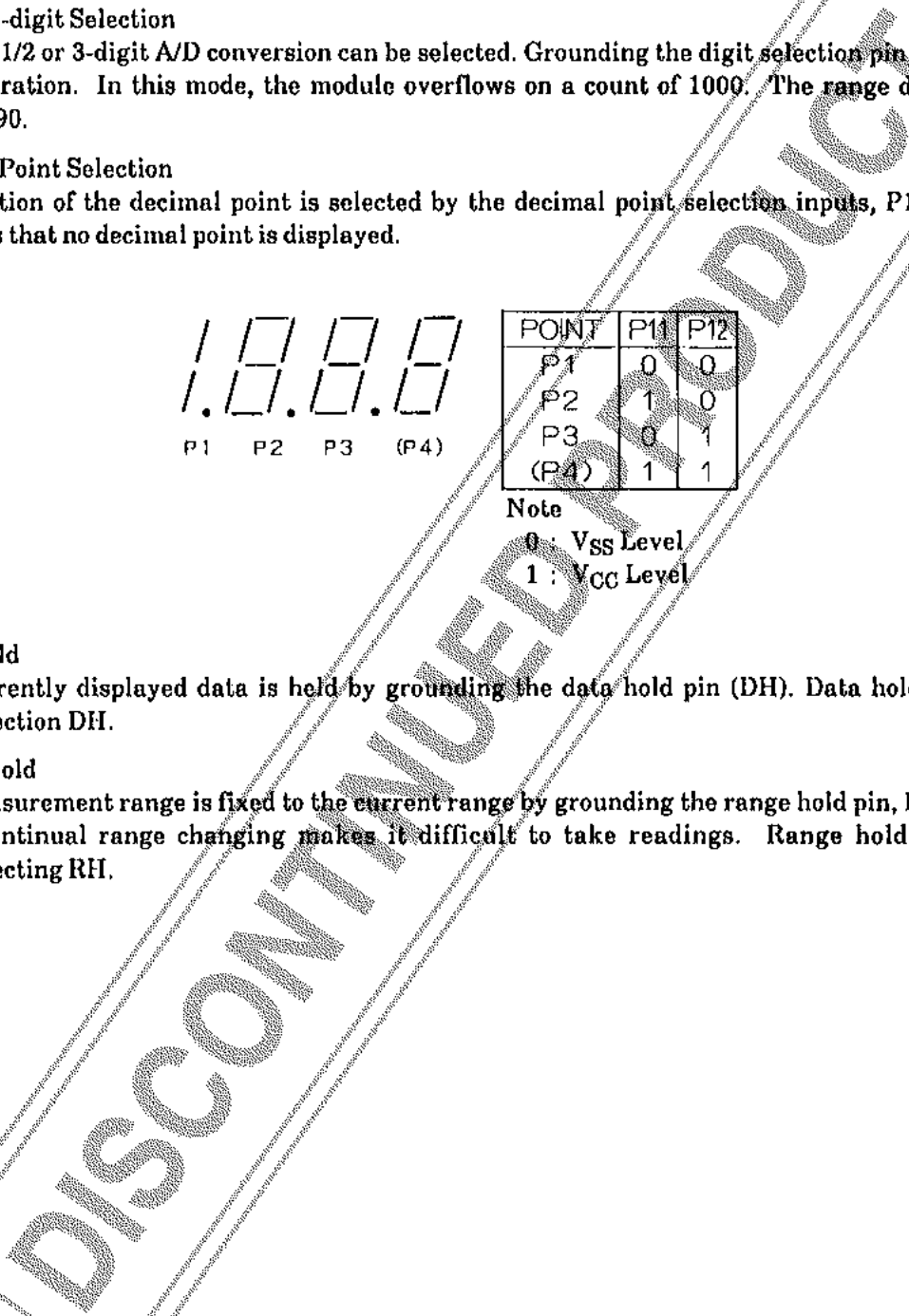
- 0 : VSS Level
- 1 : VCC Level

4) Data Hold

The currently displayed data is held by grounding the data hold pin (DH). Data hold is canceled by disconnection DH.

5) Range Hold

The measurement range is fixed to the current range by grounding the range hold pin, PH. This is used when continual range changing makes it difficult to take readings. Range hold is canceled by disconnecting RH.

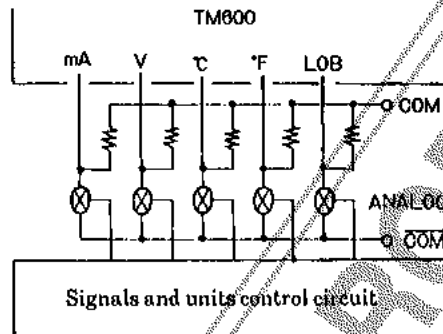


6) Range Selection

To select single range mode or auto-ranging mode, in which both the up-range output terminal and the down-range output terminal are used, ground the range setting pin (RS) to set the range to the down-range. To select two-range semi-auto mode, disconnect RS.

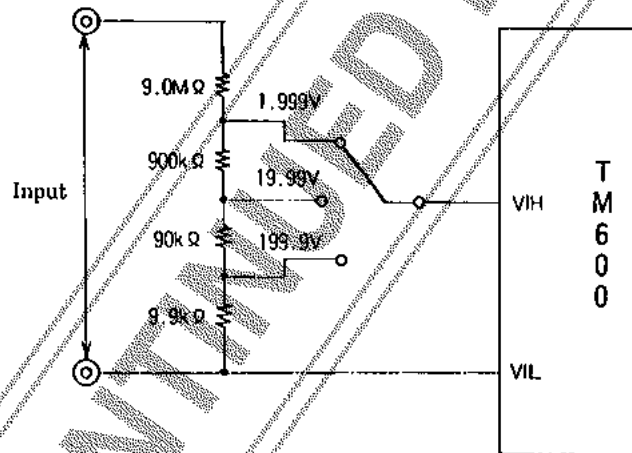
7) Units Indicators

The units indicators are turned on by grounding the appropriate units display input pin.

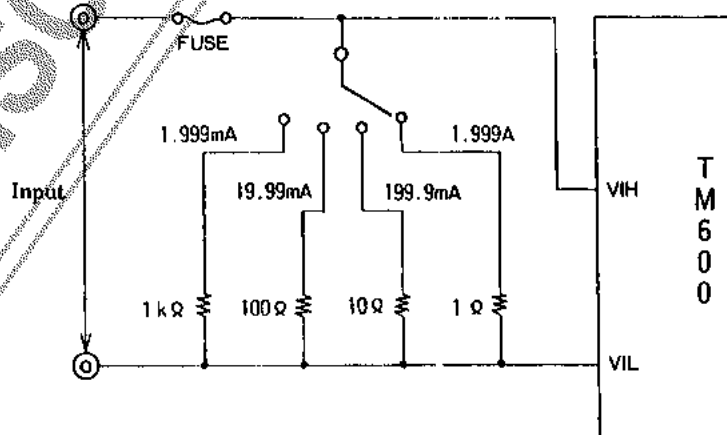


Application Circuits

1) DC voltage test circuit

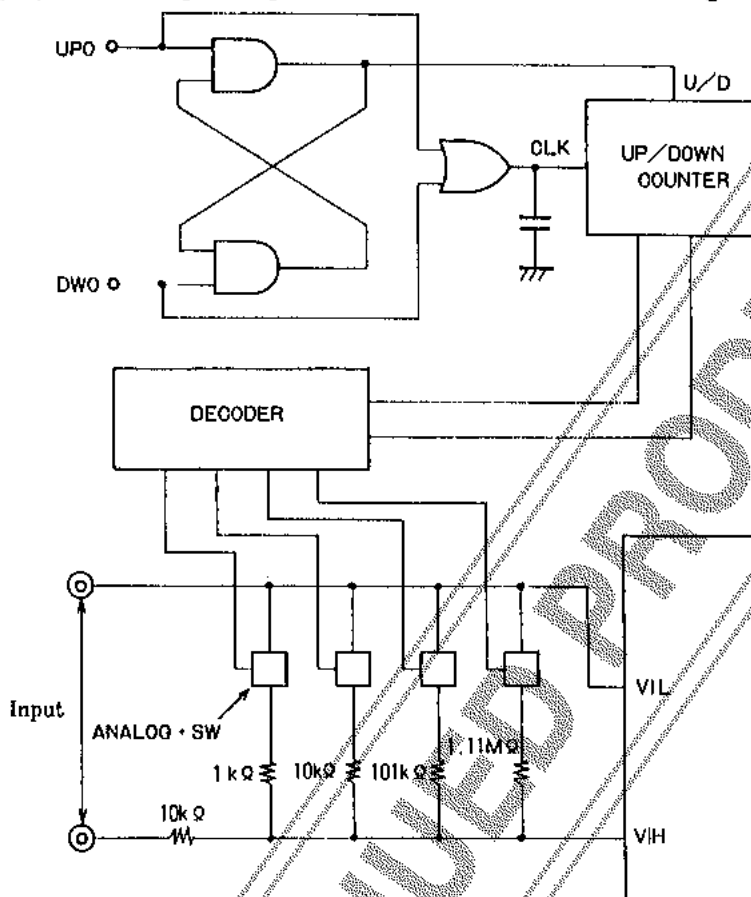


2) DC current test circuit



3) Automatic range switching circuit

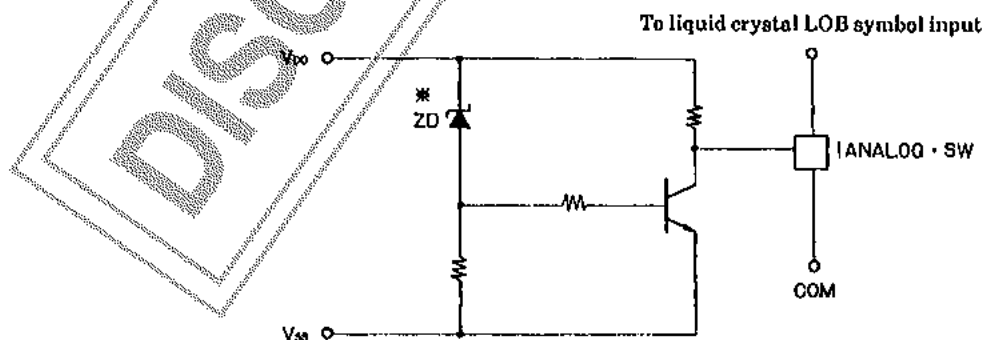
Auto-ranging on the TM600 is achieved by using the up-range (UPO) and down-range (DWO) output pins. The display switches up a range on a count of 2000 and down a range on a count of 180.



The range set pin (RS) can also be used to set the TM600 on the down range and use it in single range mode.

4) Battery check circuit

The following circuit turns the LOB symbol on when the supply voltage falls below the set voltage. ZD is a zener diode.



* For V_z of approximately 6V, the LOB symbol turns on at 6.5V.

Handling Precautions

- If the display surface is soiled, lightly wipe clean with non-greasy cotton or chamois leather, soaked in petroleum benzen.
- The panel has no protective glass covering. Handle it with care, as it is easily cracked.
- The polarizing panel is easily scratched. Do not touch it with hard objects such as glass or tweezers.
- Ground personnel through a high resistance to prevent damage from static discharge. Use a resistance of about $1M\Omega$ inserted in the earthing lead on the side nearest the person.
- Use a panel of acrylic or other material to protect the polarizing panel and liquid crystal cell.
- Design the unit so that no force will be exerted on the cover of the module. Severe bending or twisting will add considerable stress to the cell.
- Avoid using or storing the device in conditions outside those given in the recommended operating specifications.
- The life span of the cell is shortened if a voltage higher than that specified is used to drive it. Ensure that the drive voltage conforms to the recommended operating specifications.

Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

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