CMOS IC

LC7267

SANYO

Digital Display of Clock/Receiving Frequency
for Radio Set Applications

Functions

· Capable of selecting receiving frequency display/time display.

· Display of receiving frequency at each band of FM/MW/LW

Display element:	LED
Static/dynamic:	Static
Withstand voltage at output pin:	15 V
Maximum current:	18 mA
	(V_{DD} = 6.0 to 10.0 V)

· Number of display digits:
 FM: 5 digits, MW, LW: 4 digits

· Covers intermediate frequencies shown below.
  FM: +10.700, +10.725, +10.750, +10.675 MHz
            −10.700, −10.725, −10.675, −10.650 MHz
  MW, LW: +450 kHz (1) : 10 kHz-step display
            +450 kHz (2) : 1 kHz-step display
            +455 kHz   : 1 kHz-step display
            +469 kHz   : 1 kHz-step display

· In FM reception applications, the LB3500 (÷8 prescaler) is used jointly.

· Two selections of display system (12-hour system with PM sign, 24-hour system).

· Easy to set time by the time signal.

· Inhibit pin for inhibiting time setting with display unlighted.

· 7.2 MHz crystal oscillator for reference frequency.

· Supply voltage V_{DD}: 4.5 to 10.0 V.

Package Dimensions

unit : mm

3025B-DIP42S

[LC7267]

SANYO : DIP42S

63098HA (II) No.1511 - 1/10
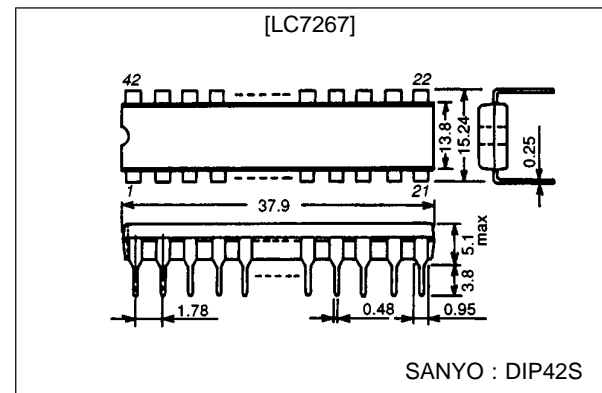
Specifications

Absolute Maximum Ratings at $V_{SS} = 0$ V

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{DD} max		−0.3 to +11	V
Input voltage	V_{IN}		−0.3 to V_{DD}+0.3	V
Output voltage	V_O1	X_{OUT}	−0.3 to V_{DD}+0.3	V
	V_O2	Output pins other than X_{OUT}, output : off	0 to 15	V
Allowable power dissipation	Pd max	Ta $\leq$ 65°C	550	mW
Allowable power dissipation of segment outputs	Pd seg 1	$\overline{PM}$ V_{DD} = 4.5 to 6 V, I_{OL} = 50 mA	35	mW
	Pd seg 2	$\overline{b\&e}$ V_{DD} = 4.5 to 6 V, I_{OL} = 33 mA	30	mW
	Pd seg 3	Other outputs V_{DD} = 4.5 to 6.5 V, I_{OL} = 16.5 mA	15	mW
	Pd seg 4	$\overline{PM}$ V_{DD} = 6.0 to 10 V, I_{OL} = 54 mA	38	mW
	Pd seg 5	$\overline{b\&e}$ V_{DD} = 6.0 to 10 V, I_{OL} = 36 mA	25	mW
	Pd seg 6	Other outputs V_{DD} = 6.0 to 10 V, I_{OL} = 18 mA	13	mW
Operating temperature	Topr		−30 to +65	°C
Storage temperature	Tstg		−40 to +125	°C

Allowable Operating Conditions at Ta = 25°C, $V_{SS} = 0$ V, V_{DD} = 4.5 to 10 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage	V_{DD}		4.5		10	V
Input high-level voltage	$V_{IH}1$	$\overline{INHI}$, CTR/CLK, DEMAND	0.8V_{DD}		V_{DD}	V
	$V_{IH}2$	SET, FM/AM	0.85V_{DD}		V_{DD}	V
	$V_{IH}3$	FIF1, FIF2, FIF3 AIF1, AIF2, 12H/24H	0.9V_{DD}		V_{DD}	V
Input low-level voltage	$V_{IL}1$	$\overline{INHI}$, CTR/CLK, DEMAND	0		0.2V_{DD}	V
	$V_{IL}2$	SET, FM/AM	0		0.15V_{DD}	V
	$V_{IL}3$	FIF1, FIF2, FIF3 AIF1, AIF2, 12H/24H	0		0.1V_{DD}	V
Input medium-level voltage	V_{IM}	SET	0.45V_{DD}		0.55V_{DD}	V
Input frequency	$f_{IN}1$	FMI, sine wave, capacitive coupling, $V_{IN}1$ = 0.7Vp-p	1		18	MHz
	$f_{IN}2$	AMI, sine wave, capacitive coupling, $V_{IN}2$ = 0.5Vp-p	0.5		3	MHz
	$f_{IN}3$	XIN, sine wave, capacitive coupling, $V_{IN}3$ = 1Vp-p	0.2		7.5	MHz
Input amplitude	$V_{IN}1$	FMI, sine wave, capacitive coupling, $f_{IN}1$ = 1 to 18 MHz	0.7		0.9V_{DD}	Vp-p
	$V_{IN}2$	AMI, sine wave, capacitive coupling, $f_{IN}2$ = 0.5 to 3 MHz	0.5		0.9V_{DD}	Vp-p
	$V_{IN}3$	XIN, sine wave, capacitive coupling, $f_{IN}3$ = 0.2 to 7.5 MHz	1.0		0.9V_{DD}	Vp-p
Segment current	Iseg 1	$\overline{PM}$			45	mA
	Iseg 2	$\overline{b\&e}$			30	mA
	Iseg 3	Other outputs seg			15	mA

Electrical Characteristics at V_{DD} = 4.5 to 10 V, $V_{SS} = 0$ V

Parameter	Symbol	Conditions	min	typ	max	Unit
Input high-level current	$I_{IH}1$	FIF1 to FIF3, AIF1 to AIF2, SET, FM/AM, 12H/24H CTR/CLK, $V_I = V_{DD}$	0		10	µA
	$I_{IH}2$	$\overline{INHI}$, $V_I = V_{SS}$	40		1000	µA
	$I_{IH}3$	DEMAND, $V_I = V_{DD}$	40		1000	µA
Input low-level current	I_{IL}	FIF1 to FIF3, AIF1 to AIF2, SET, FM/AM, 12H/24H, CTR/CLK, $V_I = V_{SS}$	−10		0	µA
Input floating voltage	$V_{IF}1$	$\overline{INHI}$, V_I = open	0		0.2	V
	$V_{IF}2$	DEMAND, V_I = open	0		0.1V_{DD}	V

Continued from preceding page.

Parameter	Symbol	Conditions	min	typ	max	Unit
Output low-level voltage	$V_{OL}1$	$\overline{PM}$ V_{DD} = 4.5 to 10 V, I_{OL} = 45 mA	0		1.0	V
	$V_{OL}2$	$\overline{b\&e}$ V_{DD} = 4.5 to 10 V, I_{OL} = 30 mA	0		1.0	V
	$V_{OL}3$	Other outputs seg, V_{DD} = 4.5 to 10 V, I_{OL} = 15 mA	0		1.0	V
Output off leakage current	I_{OFF}	All segments output pins, V_{OUT} = 13 V	0		10	µA
Current drain	I_{DD}	FM mode, FM/AM = V_{DD}, $f_{IN}1$ = 18 MHz, 0.7Vp-p (or AM mode, FM/AM = V_{SS}, $f_{IN}2$ = 3 MHz, 0.5Vp-p) $f_{IN}3$ = 7.2 MHz, 1Vp-p, FIF1, FIF2, FIF3 = V_{DD} AIF1, AIF2 = V_{DD} 12H/24H, CTR/CLK, INHI, DEMAND = V_{DD}			18	mA

Pin Assignment
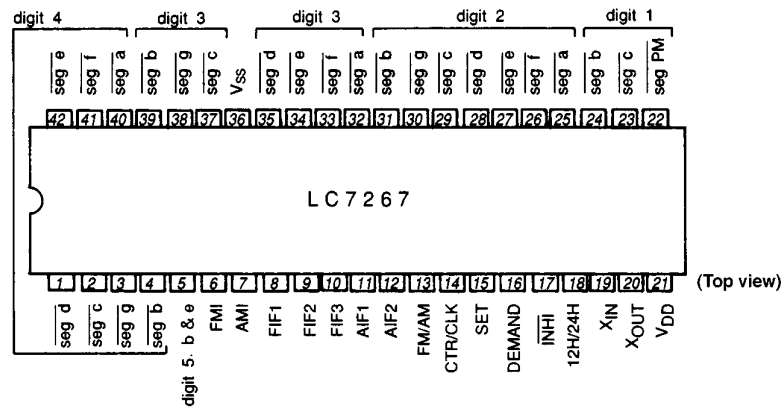
Configuration and Display Font

4 or 4-1/2-digit segment LED's are used to display time and frequency in the display font shown below.
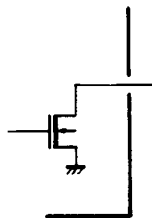
Font

Lighting System

Static lighting

Display Range

- Frequency (MW, LW)   000 kHz to 1999 kHz (The highest-order digit ''0'' is blanked out.)
- Frequency (FM)   00.00 MHz to 199.95 MHz (The highest-order digit ''0'' is blanked out.)
- Clock (12-hour)   PM 12:00 to PM 11:59 → 12:00 to 11:59

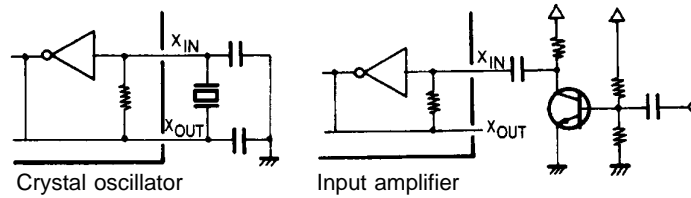- Clock (24-hour)   0:00 to 23:59 (The highest-order digit ''0'' is blanked out.)

Pin Description

- $\overline{a}$ to $\overline{g}$, $\overline{PM}$, $\overline{b\&e}$: LED driver pin

- V_{DD}, V_{SS}:   Power supply pin
- X_{IN}, X_{OUT}:   Crystal oscillator, input amplifier pin

Crystal oscillator   Input amplifier

- FIF1, FIF2, FIF3: FM IF offset value select pin

FIF1	0	0	0	0	1	1	1	1
FIF2	0	0	1	1	0	0	1	1
FIF3	0	1	0	1	0	1	0	1
IF (MHz)	+10.700	+10.725	+10.675	+10.750	−10.700	−10.725	−10.675	−10.650

- AIF1, AIF2: AM IF offset value select pin

AIF1	0	0	1	1
AIF2	1	0	0	1
IF (kHz)	+450 (1)	+450 (2)	+455	+469
Display step	10 kHz	1 kHz step		

1: High level
0: Low level

(Note) 450 kHz (1): 10 kHz-step display, others: 1 kHz-step display

- FMI, AMI: Local OSC signal input pin
   FMI: For FM
   AMI: For MW, LW

- FM/AM: FM/MW, LW select pin
   FM: High level
   MW, LW: Low level

- CTR/CLK: Frequency display/time display select pin
   CTR (Counter): High level
   CLK (Clock):   Low level

- DEMAND: Input pin for instructing execution of setting

CTR/CLK	DEMAND	MODE
0	1	Mode of setting by the time signal and hours-minutes setting mode
0	0	Time display mode

- SET: Input pin for setting hours-minutes

This pin is set at ''M'' level normally. The input signal of ''H''/''L'' level acts as follows:
When in the mode of setting by the time signal and hours-minutes setting mode (CTR/CLK = ''L'', DEMAND = ''H'')

   High level: Execution of hours setting
         Advance at a 2 Hz rate 1.2 seconds after the pin is set to ''H'' level.
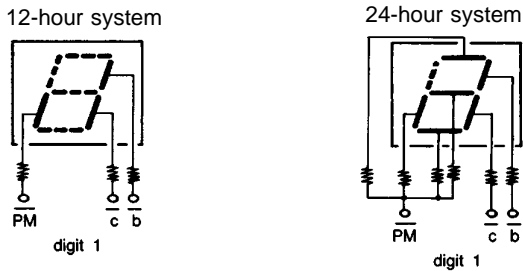   Low level: Execution of setting by the time signal and minutes setting
         Advance at a 2 Hz rate 1.2 seconds after the pin is set to ''L'' level.
         Setting by the time signal is executed when the pin is set off within 1.0 second after set to ''L'' level.
         No carry to high-order digit occurs.
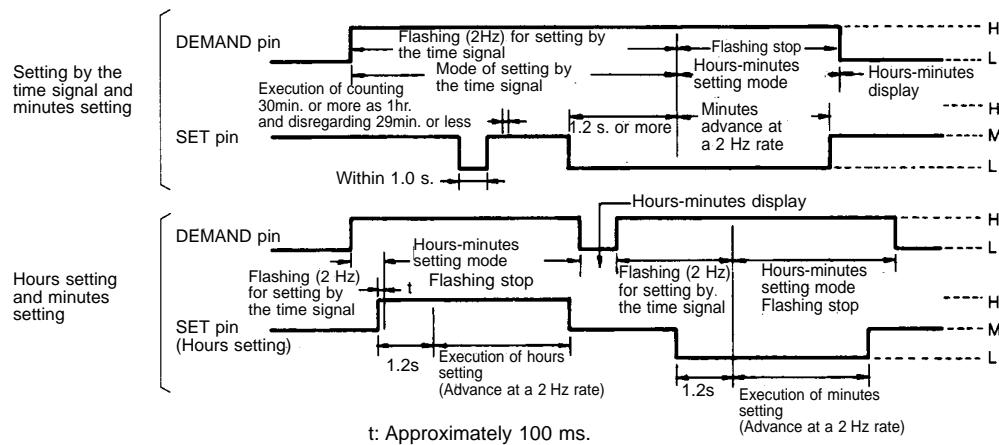
- INHI: Input pin for turning OFF the segment pins, inhibiting the SET/DEMAND pin from functioning, and preventing the AMI amp from operating

   High level: Normal operation
   Low level: Segment pin OFF, SET/DEMAND pin function inhibit

- 12H/24H: Input pin for selecting 12-hour system with PM sign/24-hour system

   High level: 12-hour system with PM sign
   Low level: 24-hour system

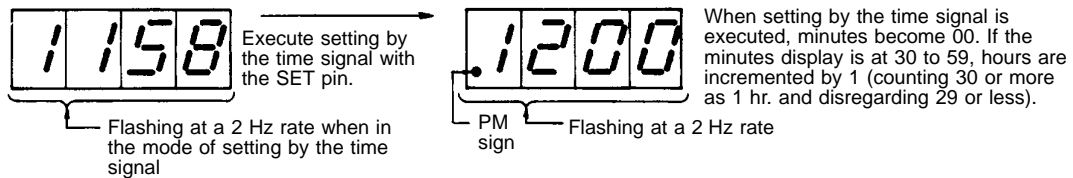Make connection of the highest-order digit as shown below.

12-hour system

24-hour system

PM   c   b

digit 1

PM   c   b

digit 1

Timing Chart

Time setting (CTR/CLK = "L")

Setting by the time signal and minutes setting

DEMAND pin
Flashing (2Hz) for setting by the time signal
Flashing stop
Hours-minutes setting mode
Hours-minutes display
H
L

Mode of setting by the time signal

Execution of counting 30min. or more as 1hr. and disregarding 29min. or less
1.2 s. or more
Minutes advance at a 2 Hz rate
H

SET pin
M
L

Within 1.0 s.

Hours setting and minutes setting

DEMAND pin
Hours-minutes display
Hours-minutes setting mode
H
L

Flashing (2 Hz) for setting by the time signal
t   Flashing stop
Flashing (2 Hz) for setting by the time signal
Hours-minutes setting mode Flashing stop
H

SET pin (Hours setting)
M
L

1.2s   Execution of hours setting (Advance at a 2 Hz rate)
1.2s   Execution of minutes setting (Advance at a 2 Hz rate)
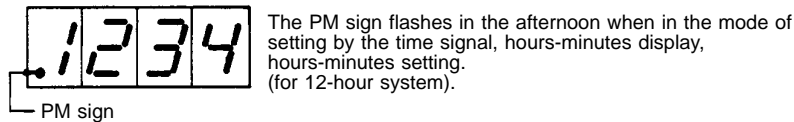
t: Approximately 100 ms.

Sample Display at Each Display

(Setting by the time signal, hours-minutes display, hours-minutes setting)

Setting by the time signal: Setting to PM 12:00
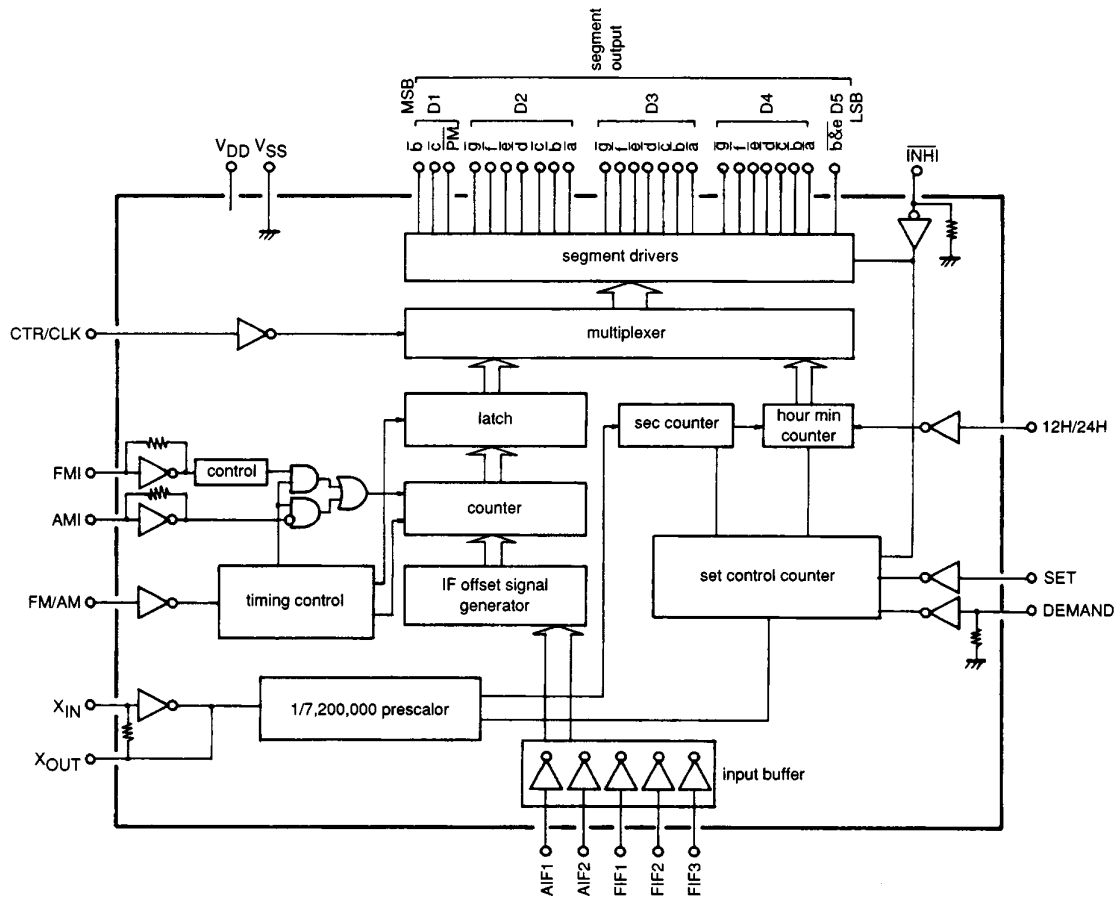

Execute setting by the time signal with the SET pin.

Flashing at a 2 Hz rate when in the mode of setting by the time signal

When setting by the time signal is executed, minutes become 00. If the minutes display is at 30 to 59, hours are incremented by 1 (counting 30 or more as 1 hr. and disregarding 29 or less).

PM sign   Flashing at a 2 Hz rate

Hours-minutes display: Display of PM 12:34

PM sign

The PM sign flashes in the afternoon when in the mode of setting by the time signal, hours-minutes display, hours-minutes setting. (for 12-hour system).

Hours-minutes setting: Setting to PM 11:45 from PM 11:23

PM sign   Flashing at a 2 Hz rate

Set the SET pin to V_{DD} or V_{SS}. After lapse of 1.2 s, flashing stops and hours or minutes advance at a 2 Hz rate.

PM sign

Set the SET pin to V_{SS}, and setting is executed.

Set the SET pin to V_{DD}, and setting is executed.
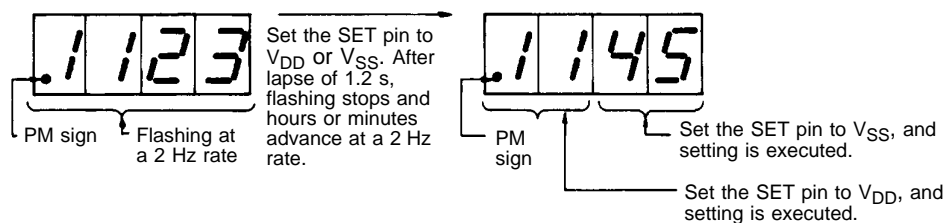
Equivalent Circuit Block Diagram

Sample Application Circuit 1

5-digit display in FM use

Sample Application Circuit 2

4-digit display in FM use

(Note) How to reduce current dissipation when display is turned off

To reduce current dissipation when display is turned off ($\overline{\text{INHI}}$: "L"), the circuit shown below must be connected to the FMI pin.

$I_{DD} - V_{DD}$

For FMI input: 18 MHz,
0.7 Vp-p FM/AM = "H"
For AMI input: 3 MHz,
0.5 Vp-p FM/AM = "L"
Common conditions
12H/24H, CTR/CLK, $\overline{INHI}$, DEMAND = V_{DD}
FIF1, FIF2, FIF3 = V_{DD}
AIF1, AIF2 = V_{DD} For FMI input
For AMI input

Current drain, I_{DD} – mA
Supply voltage, V_{DD} – V

$I_{DD} - Ta$

For FMI input: 18 MHz,
0.7 Vp-p FM/AM = "H"
For AMI input: 3 MHz,
0.5 Vp-p FM/AM = "L"
Common conditions
FIF1, FIF2, FIF3 = V_{DD}
AIF1, AIF2 = V_{DD}
12H/24H, CTR/CLK, $\overline{INHI}$, DEMAND = V_{DD}
For FMI input
For AMI input
$V_{DD}=7V$

Current drain, I_{DD} – mA
Ambient temperature, Ta – °C

Vp-p – f_{I1}

FM/AM=V_{DD}
Ta=25℃
$V_{DD}=11V$ $V_{DD}=4V$

Input amplitude, Vp-p – Ω
FMI input frequency, f_{I1} – Hz

Vp-p – f_{I2}

FM/AM=V_{SS}
Ta=25℃
$V_{DD}=11V$
$V_{DD}=4V$

Input amplitude, Vp-p – Ω
AMI input frequency, f_{I2} – Hz

$V_{DD} - f_{I1}$

FM/AM = V_{DD}
Upper standard value
V_{DD} = 15 V or more
Ta=25℃
Ta=70℃
Ta=−30℃

Supply voltage, V_{DD} – V
FMI input frequency, f_{I1} – Hz

$V_{DD} - f_{I2}$

Ta=−30℃
Upper standard value
Lower standard value
Ta=70℃
Ta=−30℃
Ta=25℃

Supply voltage, V_{DD} – V
AMI Input Frequency, f_{I2} – Hz

Vt – V_{DD}

$\overline{INHI}$ threshold voltage, V_t – V
Supply voltage, V_{DD} – V

Vt – V_{DD}

High-level
threshold voltage
Upper standard
value
Lower standard value
Low-level threshold voltage

SET threshold voltage, V_t – V
Supply Voltage, V_{DD}–V

$I_{OL} - V_{OL}$

Segment outputs other than $\overline{PM}$, 5b&e
This data is in case of flowing current to one segment only.

Ta＝25℃

Output current, I_{OL} – mA

$V_{DD}=10V$
$V_{DD}=4.5V$

Output voltage, V_{OL} – V

$R_{OUT} - V_{DD}$

Ta＝25℃

Output impedance, R_{OUT} – Ω

Segment output (I_{OL} = 30 mA) of 5b&e

Segment outputs (I_{OL} = 15 mA) other than $\overline{PM}$, 5b&e

Segment output (I_{OL} = 45 mA) of $\overline{PM}$

Supply voltage , V_{DD} – V