

AN6997K

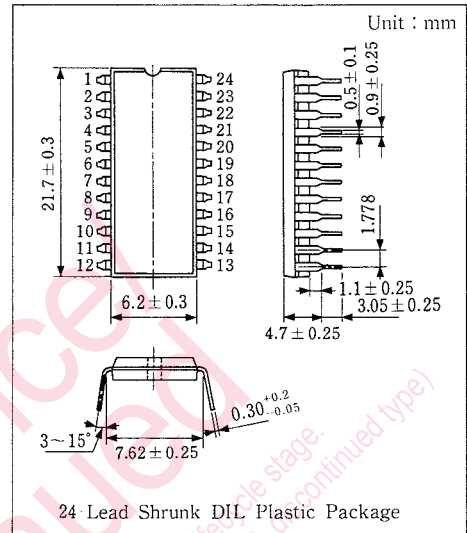
2-Digit 7-Segment LED Decoder Driver Circuit

■ Outline

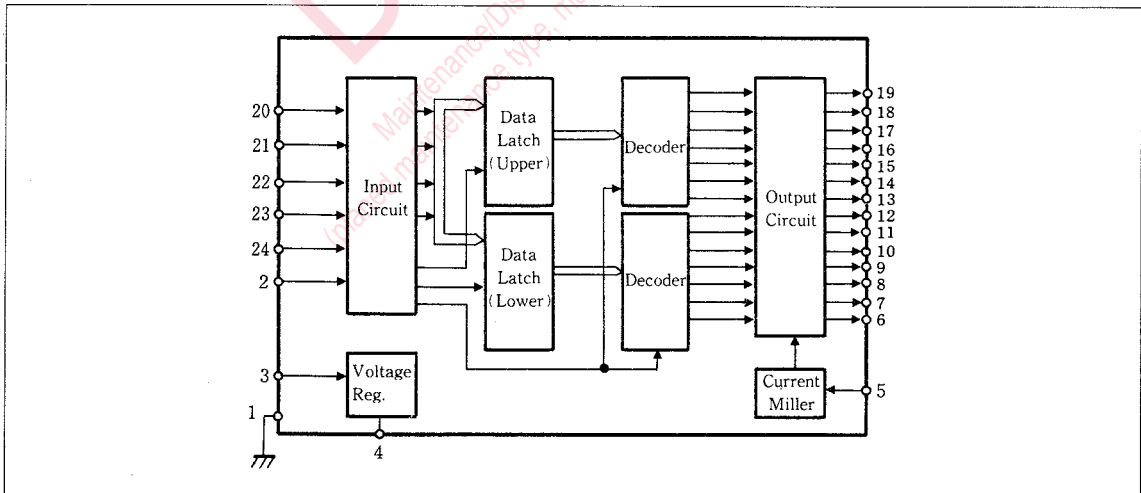
The AN6997K is an integrated circuit designed for directly driving 2-digit LED numerical display elements with bipolar.

■ Features

- Decoder driver with latch for 2-digit LED numerical display elements
- I²L is used for logic circuit
- Assembly cost is greatly reduced due to direct connection to each segment without resistors for current limit
- With one external resistor continuous brightness control of all segment is possible
- No flicker and no noise due to static display
- Up to 5 alphabet characters designated by user can be added by programmable mask.



■ Block Diagram



■ Pin

Pin No.	Pin Name	Pin No.	Pin Name
1	GND	13	Display Output c ₁
2	$\overline{\text{BLK}}$	14	Display Output d ₁
3	V _{CC}	15	Display Output e ₁
4	V _S	16	Display Output f ₁
5	BRT	17	Display Output g ₁
6	Display Output f ₂	18	Display Output a ₁
7	Display Output a ₂	19	Display Output b ₁
8	Display Output b ₂	20	Date Input x ₀
9	Display Output c ₂	21	Date Input x ₁
10	Display Output g ₂	22	Date Input x ₂
11	Display Output d ₂	23	Date Input x ₃
12	Display Output e ₂	24	DSEL

■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V _{CC}	16	V
Supply Current	I _{CC}	13.5	mA
Input Pin Voltage	V _{2,20,21,22,23,24-1}	16	V
Output Pin voltage*1	V ₆₋₁ ~V ₁₉₋₁	16	V
Brightness Pin Current	I _S	+15	mA
Output Pin Current*1	I ₆ ~I ₁₉	+15	mA
Power Dissipation*2	P _D	600	mW
Operating Ambient Temperature	T _{opr}	-20~+75	°C
Storage Temperature	T _{stg2}	-50~+150	°C

*1 The value of supply current should be selected within power dissipation. *T_a=75°C

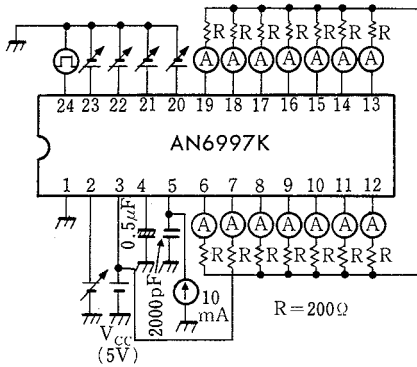
Note1) When used at 5V or more, refer to Page 342 (Max. Allowable Current (75°C) for V_{CC}).

Note2) Operating Supply Voltage Range: V_{CC(oper)}=4.5~16V

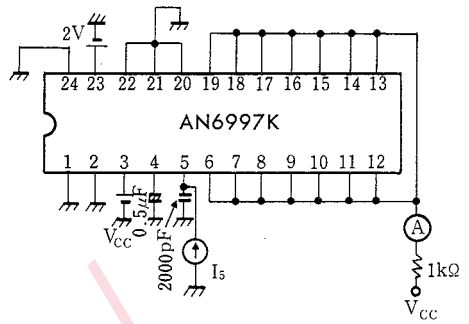
■ Electrical Characteristics (Ta=25°C)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Input Voltage	V _{IH}	1		2			V
	V _{IL}	1				0.8	
Output Current	I _{OL}	1	V _{CC} =5V, I _S =10mA	8	9.5	11	mA
	I _{OH1}	2	V _{CC} =5V, I _S =10mA			10	μA
	I _{OH2}	2	V _{CC} =16V, I _S =5mA			10	
Supply Current	I _S	3	V _{CC} =5V	6	10	13	mA
			V _{CC} =16V	6.5	11	13.5	
Input Current	I _{IH}	4	V _{CC} =16V			10	μA
	I _{IL}	5	V _{CC} =16V	-30			
Brightness Pin Voltage	V _{S-1}	6	V _{CC} =5V, I _S =15mA	3	4	5	V
Internal Voltage	V ₄₋₁	7	V _{CC} =5V, I _S =10mA	2.4	2.8	3.2	V

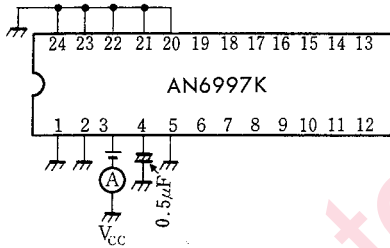
Test Circuit 1 (V_{IH} , V_{IL} , V_{OL})



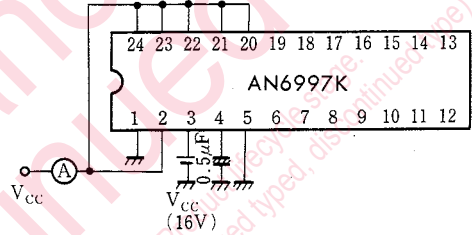
Test Circuit 2 (I_{OH1} , I_{OH2})



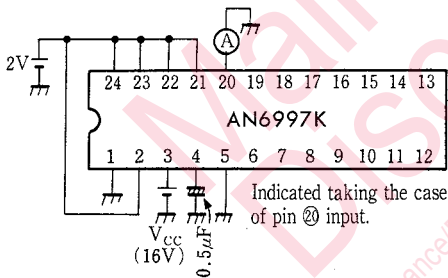
Test Circuit 3 (I_3)



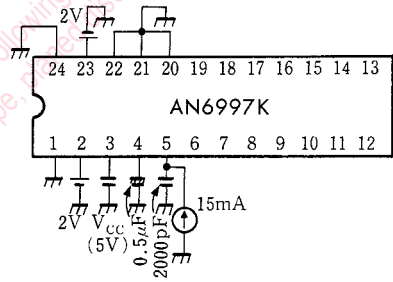
Test Circuit 4 (I_{IH})



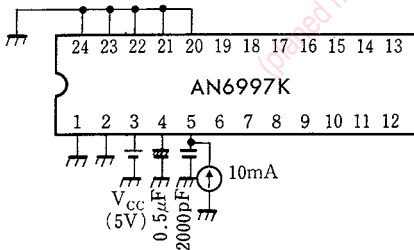
Test Circuit 5 (I_{IL})



Test Circuit 6 (V_{5-1})



Test Circuit 7 (V_{4-1})

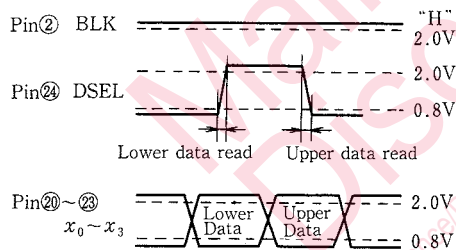


■ Input Code

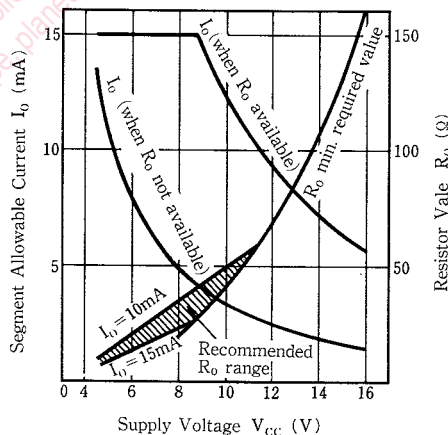
BLK	Input				Output								Indicate						
	X ₃	X ₂	X ₁	X ₀ (LSB)	a ₁	a ₂	b ₁	b ₂	c ₁	c ₂	d ₁	d ₂		e ₁	e ₂	f ₁	f ₂	g ₁	g ₂
L	×	×	×	×	H		H		H		H		H		H		H		Lamp OFF
H	L	L	L	L	L		L		L		L		L		L		H		0
H	L	L	L	H	H		L		L		H		H		H		H		1
H	L	L	H	L	L		L		H		L		L		H		L		2
H	L	L	H	H	L		L		L		L		H		H		L		3
H	L	H	L	L	H		L		L		H		H		L		L		4
H	L	H	L	H	L		L		H		L		H		L		L		5
H	L	H	H	L	L		H		L		L		L		L		L		6
H	L	H	H	H	L		L		L		H		H		L		H		7
H	H	L	L	L	L		L		L		L		L		L		L		8
H	H	L	L	H	L		L		L		L		H		L		L		9
H	H	L	H	L	H		L		L		L		L		L		H		U
H	H	L	H	H	L		H		H		H		L		L		L		F
H	H	H	L	L	H		H		H		H		H		H		H		Lamp OFF
H	H	H	L	H	H		H		H		H		H		H		H		Lamp OFF
H	H	H	H	L	H		H		H		H		H		H		H		Lamp OFF
H	H	H	H	H	H		H		H		H		H		H		H		Lamp OFF

Note1) The input signal level is compatible with TTL specification. "L" level : 0.8V or less "H" level : 2.0V or more.
 Note2) Symbol "X" denotes that either H or L is available.
 Note3) The operation of DSEL signal is as follows. L→H Reads the lower numerical data. H→L Reads the upper numerical data.

Read cycle Timing Chart



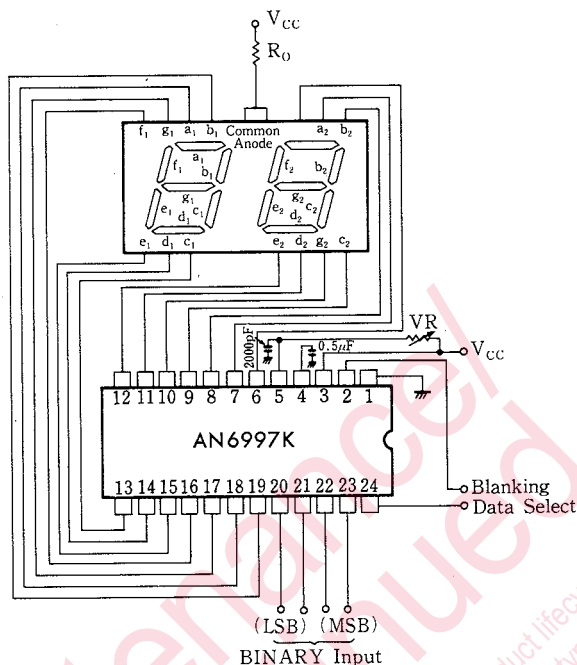
Max. Allowable Current (75°C) for V_{CC}



R₀ is resistor to be inserted between LED common anode and V_{CC} to share a part of IC power consumption.

Example : When V_{CC} = 5V and R₀ = 10Ω, I₀ can be generated up to 15mA.

■ Connection Diagram



■ How to Used and Precautions

1. Setting Segment Current

The AN6997K can directly drive 2-digit 7-segment common anode type LED (refer to the external connection diagram). Since the output pin serves as the open collector, the current for each segment is supplied in constant current from the current circuit. The values of each segment current can be set with the resistor (VR) inserted between BRT pin and Vcc. The current values are almost equal to those which flow into the BRT pin. Therefore, no external is needed for the cathode side of LED. If VR is made variable resistor, the brightness of LED can be varied continuously.

2. Max. Allowable Value of Segment Current

The max. allowable segment current cannot be set irrespective of Vcc due to restrictions of power dissipation. A curve of max. allowable current indicates the relationship to Vcc. When taking a large segment current at high Vcc, insert the resistor R₀ between

LED common anode and Vcc to share a part of power dissipation. In this case, care should be taken for the fact max. power dissipation of IC is generated when about half of segments (7 or 8 segments) are turned ON for display but not for all the segments ON. For example, if the segment current is 10mA at Vcc=5 V, R₀ is not required. However, if 15 mA current flows, 10 Ω will be needed as R₀.

3. BLK Pin

BLK pin is kept OFF during "L" level, while the original display appears when making BLK pin "H" level.

4. DESL Pin

DESL pin is internally connected to the latch flip-flop T pin. Data is fetched between at the rising edge and falling edge. Chattering is to be avoided in the switching operation.

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