

## LM1017 4-Bit Binary 7-Segment Decoder/Driver

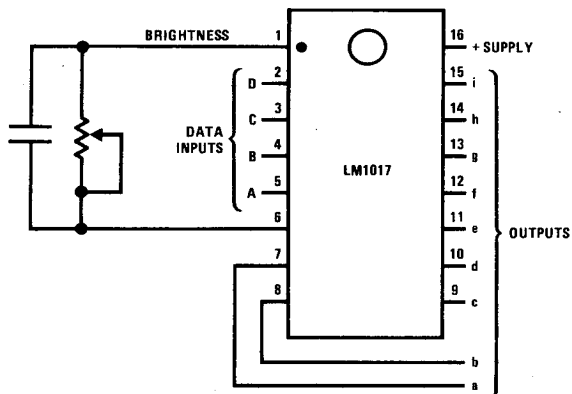
### General Description

The LM1017 is a monolithic IC which decodes 4-bit "binary plus one" coded input signals and supplies 1 1/2-digit TV channel display information. The outputs are designed to drive a 7-segment common cathode LED display with up to 25 mA depending on thermal dissipation requirements. Improvements in circuit design enable the device to operate from 5V to 12V supply. A brightness control facility is included.

### Features

- A direct replacement for SN29764 but with 12V supply capability
- TTL compatible inputs with high input voltage immunity
- Channel displays are from 1 to 16
- Current-driven output stages for LEDs protect against excess thermal dissipation
- Continuously variable brightness control
- Low stand-by quiescent current supply consumption
- Suitable for NSN583 0.5 inch LED display
- Inputs are suitable for direct drive from MOS outputs

### Connection Diagram



Order Number LM1017N  
See NS Package N16A

$V_{SUPPLY} = 5V$

For 12V supply, external resistors must be used between the output pin and segment to limit device dissipation.

## Absolute Maximum Ratings

Supply Voltage, Pin 16	13.5V	Storage Temperature Range	-55°C to +150°C
Input Voltage, Pins 2–5	30V	Junction Temperature	150°C
Input Voltage, Pin 1	13.5V	Lead Temperature (Soldering, 10 seconds)	300°C
Operating Temperature Range	0°C to +70°C		

## Electrical Characteristics $V_{16} = 5V, T_A = 25^\circ C$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Current per Segment Quiescent Current, Pin 16	Pin 1 = 2V Pin 1 = 5V		12 4	20	mA
Input Logic Voltage	Pins 2–5				
H Signal		2			V
L Signal				0.8	V
Input Current, Pins 2–5	$V_{2-5} = 2.4V$ $V_{2-5} = 0V$			1 -5	$\mu A$ $\mu A$
Input Current, Pin 1	$I_{7-15} = -15 \text{ mA}$		-350		$\mu A$
Output Current, Pins 7–15	$V_1 = 0V$ $V_1 = 2V$ $V_1 = V_{16}$	-16	-22 -12		mA mA $\mu A$
Minimum Saturation Between Output Terminals 7–15 and 16	$I_{OUT} = -20 \text{ mA}$		1.4	-20	V
Package Thermal Resistance, $\theta_{JA}$				100	°C/W

Note. To limit device temperature at supply voltages  $> 5V$ , the following condition must be maintained:  $8 (V_{SUPPLY} - V_{OUT}) I_{OUT} < \frac{150 - T_A}{\theta_{JA}}$ .

Eg. For 12V supply and 20 mA  $I_{OUT}$  into 2V LED,  $T_A = 25^\circ C$ :  $8 (12 - V_O) 0.02 < \frac{125}{100}$

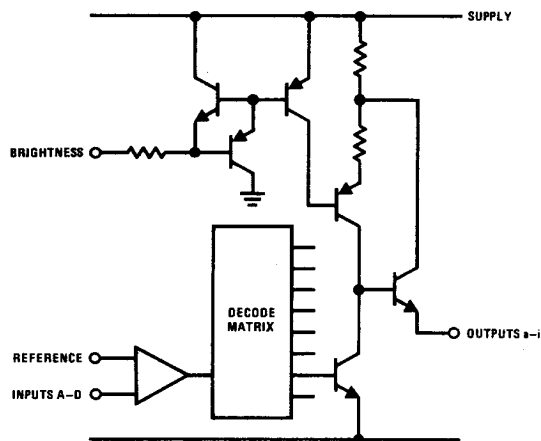
i.e.,  $V_O > 4.2V$  ∴ series output resistance =  $\frac{2.2V}{20 \text{ mA}} = 110\Omega$ .

See application notes for use of common series resistance between LED cathodes and ground.

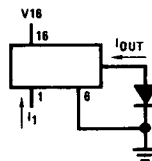
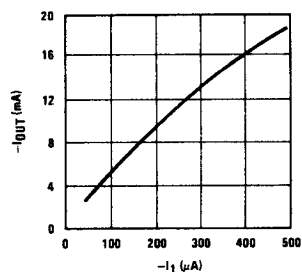
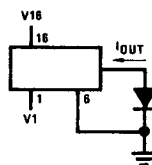
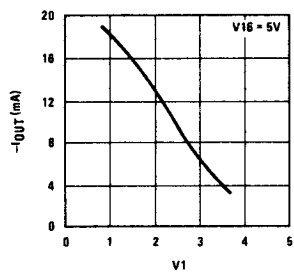
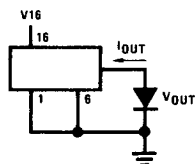
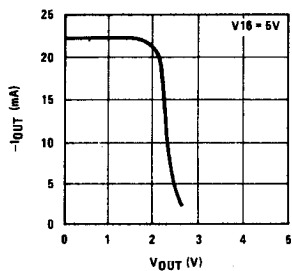
## Truth Table

CHANNEL	INPUT					OUTPUT									
	D	C	B	A	BR	a	b	c	d	e	f	g	h	i	
1	L	L	L	L	L		ON	ON							
2	L	L	L	H	L	ON	ON		ON	ON		ON			
3	L	L	H	L	L	ON	ON	ON	ON			ON			
4	L	L	H	H	L		ON	ON			ON	ON			
5	L	H	L	L	L	ON		ON	ON		ON	ON			
6	L	H	L	H	L	ON		ON	ON	ON	ON	ON			
7	L	H	H	L	L	ON	ON	ON							
8	L	H	H	H	L	ON	ON	ON	ON	ON	ON	ON			
9	H	L	L	L	L	ON	ON	ON	ON		ON	ON			
10	H	L	L	H	L	ON	ON	ON	ON	ON	ON		ON	ON	
11	H	L	H	L	L		ON	ON					ON	ON	
12	H	L	H	H	L	ON	ON		ON	ON		ON	ON	ON	
13	H	H	L	L	L	ON	ON	ON	ON			ON	ON	ON	
14	H	H	L	H	L		ON	ON			ON	ON	ON	ON	
15	H	H	H	L	L	ON		ON	ON		ON	ON	ON	ON	
16	H	H	H	H	L	ON		ON	ON	ON	ON	ON	ON	ON	
OFF	X	X	X	X	H										

# Circuit Schematic (One Circuit Shown)



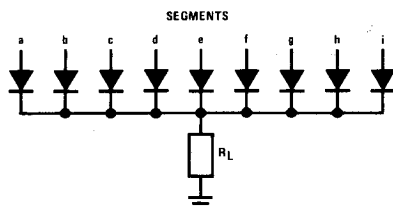
## Output Characteristics



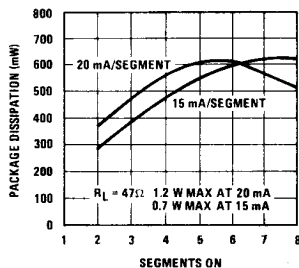
## Typical Applications

When operating with a 12V supply line, it is necessary to limit the power dissipation in the IC by means of external resistance in series with the LED segments. (Max package dissipation at 70°C = 800 mW.)

A minimum voltage of 2.5V should be allowed across the output driver pins between supply and outputs. Allowing 1.4V for the LED segments, a simple economical solution using *only 1 resistor* can be proposed as follows:



Maximum no of ON segments = 8



For 20 mA/segment, maximum voltage allowed across R<sub>L</sub> will be:

$$12 - 2.5 - 1.4 \cong 8V$$

$$\therefore R_L \text{ max} = 8/8 \times 0.02 \cong 47\Omega$$

For 15 mA/segment (max), R<sub>L</sub> max = 56Ω.

**Alternative methods of limiting P<sub>D</sub> at 12V supply.**

With a series resistance between each output and segment, the recommended resistance per segment at 20 mA maximum will be:

$$(12 - 2.5 - 1.4)/0.02 \cong 390\Omega$$

If a zener is used, maximum zener voltage = 8V. (The zener can be common between LED display cathode and ground.)

