CMOS BCD-TO-SEVEN SEGMENT LATCH/DECODER/DRIVER

FEATURES

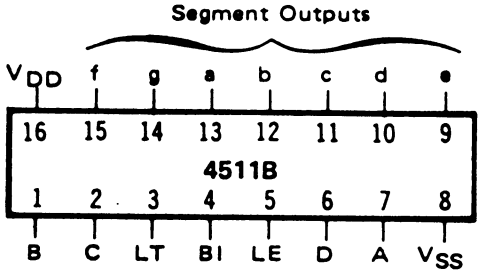
- High-Current Sourcing Bipolar Outputs (Up to 25 mA)
- Latched Storage of Input Code
- Blanking Input for Display Intensity Modulation
- Lamp Test Provision
- Readout Blanking for Illegal Input Combinations

DESCRIPTION

The 4511B provides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and an output drive capability to source up to 25 mA of current. Lamp Test, Blanking, and Latch Enable inputs are used to test the display, turn off the display, and store a BCD code, respectively. It can be used with LED, incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly.

Applications include counter display drivers, seven-segment decimal display, and various clock, watch, and timer uses.

CONNECTION DIAGRAM
(all packages)



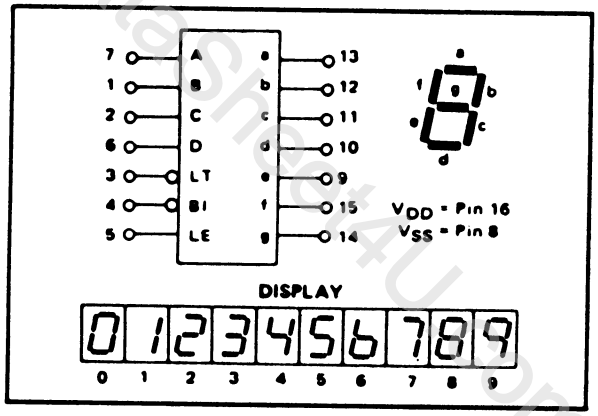
TRUTH TABLE

LE	BI	LT	D	C	B	A	a	b	c	d	e	f	g	DISPLAY
X	X	0	X	X	X	X	1	1	1	1	1	1	1	8
X	0	1	X	X	X	X	0	0	0	0	0	0	0	Blank
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	0	1	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	1	0	0	0	0	0	0	0	Blank
1	1	1	X	X	X	X	*							*

X = Don't care

* Depends upon the BCD code applied during the 0 to 1 transition of LE.

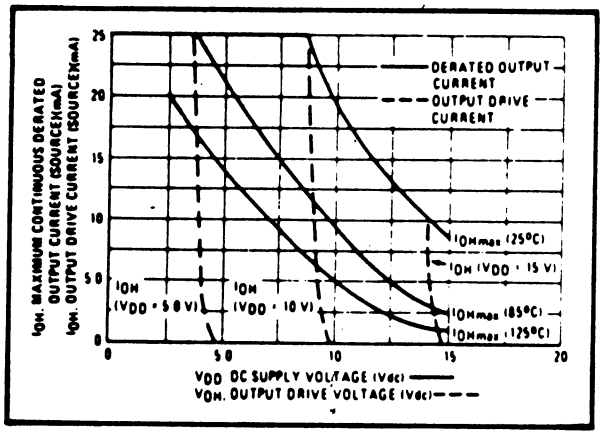
BLOCK DIAGRAM



RECOMMENDED OPERATING CONDITIONS

For maximum reliability:

DC Supply Voltage	$V_{DD} - V_{SS}$	3 to 15	Vdc
Operating Temperature	T_A		
C		-55 to +125	°C
E		-40 to +85	°C



Typical P-Channel
Source Current Characteristics

The maximum continuous (worst case) derated output drive current applies to a single output with all other outputs sourcing an equal amount of current. Operation above the derating curve at a given temperature is not recommended.

STATIC CHARACTERISTICS[1]

PARAMETER		V_{DD} (Vdc)	CONDITIONS	T_{LOW}[2] Min.	T_{LOW}[2] Max.	+25°C Min.	+25°C Typ.	+25°C Max.	T_{HIGH}[2] Min.	T_{HIGH}[2] Max.	Units
QUIESCENT DEVICE CURRENT	I_{DD}	5	$V_{IN} = V_{SS}$ or V_{DD}	–	5	–	0.05	5	–	150	μAdc
		10	All valid input	–	10	–	0.1	10	–	300	
		15	combinations	–	20	–	0.2	20	–	600	
OUTPUT DRIVE VOLTAGE	V_{OUT}	5	$I_{OH} = 0$ mAdc	4.99	–	4.99	5.0	–	4.95	–	Vdc
			- 5	–	–	–	4.25	–	–	–	
			- 10	–	–	3.9	4.13	–	–	–	
			- 15	–	–	–	3.95	–	–	–	
			- 20	–	–	3.4	3.75	–	–	–	
			- 25	–	–	–	3.5	–	–	–	
		10	$I_{OH} = 0$mAdc	9.99	–	9.99	10	–	9.95	–	Vdc
			- 5	–	–	–	9.25	–	–	–	
			-10	–	–	9.0	9.15	–	–	–	
			-15	–	–	–	9.03	–	–	–	
			-20	–	–	8.6	8.90	–	–	–	
			- 25	–	–	–	8.75	–	–	–	
		15	$I_{OH} = 0$mAdc	14.99	–	14.99	15	–	14.96	–	Vdc
			- 5	–	–	–	14.25	–	–	–	
			-10	–	–	14.0	14.18	–	–	–	
			-15	–	–	–	14.08	–	–	–	
			-20	–	–	13.6	13.95	–	–	–	
			-25	–	–	–	13.80	–	–	–	
OUTPUT LOW (SINK) CURRENT	I_{OL}	5	$V_{OL} = 0.4V$	1.2	–	0.9	1.5	–	0.7	–	mAdc
		10	$V_{OL} = 0.5V$	1.9	–	1.7	4.0	–	1.4	–	
		15	$V_{OL} = 1.5V$	10.0	–	9.0	11.0	–	7.5	–	
			$V_{IN} = V_{SS}$ or V_{DD}								

NOTES: [1] Remaining Static Electrical Characteristics are listed under "4000B Series Family Specifications".
[2] T_{LOW} = -55°C for C
= -40°C for E
T_{HIGH} = +125°C for C
= + 85°C for E

DYNAMIC CHARACTERISTICS (C_L = 50pF, T_A = 25°C)

PARAMETER		V_{DD} (Vdc)	Min.	Typ.	Max.	Units
PROPAGATION DELAY TIME						
From Data Inputs	t_{PLH}	5	–	520	1040	ns
		10	–	210	420	
		15	–	150	300	
	t_{PHL}	5	–	660	1320	ns
		10	–	260	520	
		15	–	180	360	
From Blanking Input	t_{PLH}	5	–	300	600	ns
		10	–	125	250	
		15	–	100	200	
	t_{PHL}	5	–	500	1000	ns
		10	–	200	400	
		15	–	160	320	
From Lamp Test Input	t_{PLH}	5	–	300	600	ns
		10	–	120	240	
		15	–	90	180	
	t_{PHL}	5	–	325	650	ns
		10	–	130	260	
		15	–	95	190	
OUTPUT TRANSITION TIME	t_{TLH}	5	–	170	250	ns
		10	–	120	200	
		15	–	100	180	
	t_{THL}	5	–	400	900	ns
		10	–	225	450	
		15	–	200	400	
MINIMUM DATA INPUT SETUP TIME	t_{setup}	5	–	90	180	ns
		10	–	40	80	
		15	–	20	40	
MINIMUM DATA INPUT HOLD TIME	t_{hold}	5	–	-90	0	ns
		10	–	-40	0	
		15	–	-20	0	
MINIMUM LATCH ENABLE PULSE WIDTH	PW_{LE}	5	–	260	520	ns
		10	–	110	220	
		15	–	65	130	

LOGIC DIAGRAM